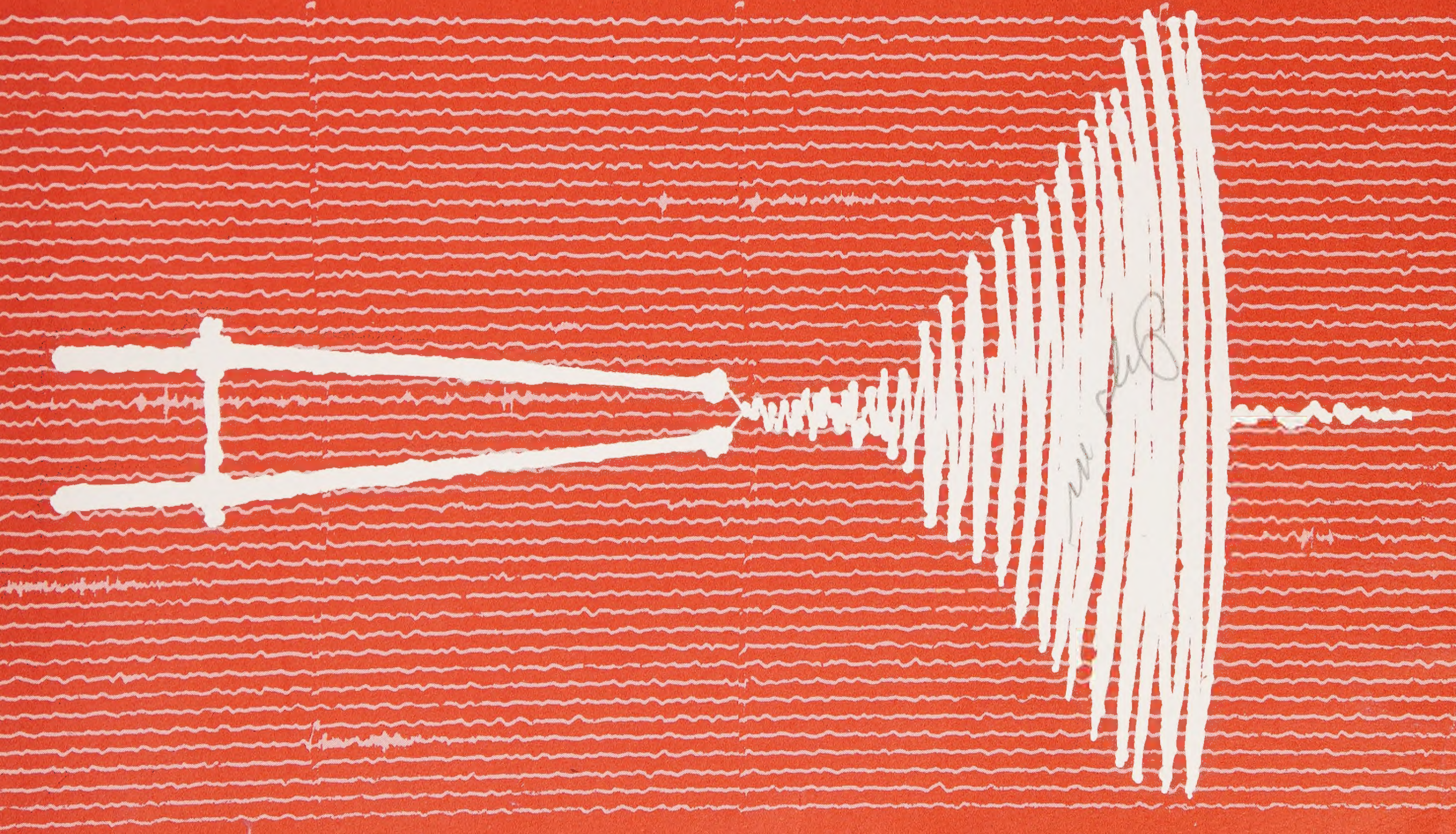
SEISMIC & SAFETY ELEMENTS OF THE GENERAL PLAN



SAN MATEO COUNTY PLANNING DEPARTMENT · CALIFORNIA

ADDENDA

SPECIFIC ISSUES FOR THE TOWN OF PORTOLA VALLEY (Follows page 29 of Volume I)

Geotechnical issues within the Town of Portola Valley are (1) landsliding, (2) expansive soils*, (3) faulting accompanied with surface rupture and severe ground shaking, and (4) flood potential within Corte Madera Creek.

Landsliding is extensive and varies from shallow, surficial failures to deep-seated movements. The majority of the landslides are southwest of the San Andreas fault zone and involve Tertiary formations with expansive clays and shales. Expansive soil is a known geologic hazard within Portola Valley. Soils most detrimental to foundations are commonly the weathered product of these formations with expansive shales. Depth of the soils is known to extend to greater than 15 feet, with the greater depths at the toe of slopes and in drainage courses. Under the influence of gravity, expansive soils are subject to slope creep when saturated.

The San Andreas fault zone transects Portola Valley, along which surface rupture was recorded during the 1906 earthquake. In the event of another such earthquake, severe ground shaking can be anticipated, accompanied by surface displacement and strong lateral loading forces. New landslides, and the reactivation of older ones, may occur during such an event and may compound damage. Surface displacement can be expected anywhere within the rift zone.

In the event of a 100-year storm, flooding can be expected to occur along Corte Madera Creek, as indicated on the Geotechnical Hazards Synthesis Maps.

Safety issues in Portola Valley include very extreme hazard from catastrophic* fire, potential geographic isolation, and inadequacy of acute medical care facilities. The wildland fire hazard results from the densely wooded nature of Portola Valley, compounded by the rural nature of its development and its narrow roads. The fact that there are no fire hydrants in the undeveloped parts of the Town intensifies this hazard.

Potential isolation is another problem facing Portola Valley, especially after a major seismic event. Currently, access to the Town is gained via only three routes: Portola Road, Alpine Road (west) and Alpine Road (east). Portola Road and Alpine Road (east) may be closed due to failure of bridges and structures across Interstate 280. Alpine Road (west) may be expected to be blocked due to landslides. Thus, the Town of Portola Valley is faced with the need to become fairly self-sufficient in the event of a catastrophe. This includes the need to provide emergency acute medical care at least on an interim basis. The medical center at The Sequoias Retirement Community may be able to partially mitigate this problem.

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*See Glossary (vol. II, Appendix A)

ADDENDA

SPECIFIC ISSUES FOR THE CITY OF DALY CITY (Follows Page 21, Volume I)

Safety issues in Daly City are relatively limited, and are generally associated with the potential for isolation which exists in the City. Transected by Interstate 280, the Skyline Freeway (State Route 35), and Highway 1, much of the circulation in the City involves freeway underpasses and overpasses, as well as three major freeway interchanges. Should these structures be severely damaged or destroyed (as may be expected in a major seismic event), substantial portions of the City would be cut off from each other, and the provision of emergency services would be substantially curtailed. This isolation would also inhibit the repair of basic utility services, until access could be regained. Without the provision of emergency first aid stations or mobile hospital units within the cut off areas, the access problem could result in loss of life and limb due to the inability to obtain medical treatment.

Localized flooding from seismic activity in the western portion of the City is another potential problem. Several high-pressure water lines belonging to the San Francisco Water Department run through Daly City. Damage to these lines, which cross Interstate 280 in overpass structures, would result in flooding and would deprive the City of an appreciable amount of water supply.

SEISMIC & SAFETY ELEMENTS OF THE GENERAL PLAN

VOLUME ONE: GOALS, POLICIES AND PROGRAMS

ADOPTED BY SAN MATEO COUNTY BOARD OF SUPERVISORS • DECEMBER, 1976

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SPECIAL ACKNOWLEDGEMENTS:

Engineering Decision Analysis Company (risk analysis consultants)
Dr. Haresh Shah, Stanford University (risk analysis consultants)
Leighton & Associates (geotechnical engineering consultants)
San Mateo Area Disaster Office
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PREFACE

The combined Seismic Safety/Safety Element has been undertaken as a major substantive metropolitan planning effort of the Joint Cities/County Planning Task Force of San Mateo County. This planning program comprehensively evaluates those natural hazards which endanger public safety and which acknowledge no political boundaries. This document is intended to serve four purposes, in addition to fulfilling the legal mandate discussed in Chapter I of this volume. These are: 1) to identify, delineate, and evaluate potential natural hazards, including geotechnical and fire hazards; 2) to identify goals, objectives, policies, and potential implementation programs to reduce risk to an acceptable level: 3) to integrate data on geotechnical and other natural hazards into the decision-making process at the local level, and 4) to provide policy guidance to the decision-makers of the participating jurisdictions.

The Seismic Safety/Safety Element has been divided into two parts, accompanied by a folder containing the Geotechnical Hazard Synthesis Maps, legends and explanation. Volume I, the policy planning document, contains the problem statement, issues, purpose, goals and objectives of the Element, and policies and implementation programs.

Volume II is the technical supplement, which contains an enumeration and evaluation of various types of natural hazards which occur in San Mateo County. The impact of potential catastrophes is also discussed, with particular attention to the effects of earthquakes on structures and critical facilities. This aspect is examined in greater detail in the Risk Analysis Technical Report, contained in Appendix C of Volume II. Appendix A is a glossary of terms used throughout the report, and Appendix B contains an enumeration of the major rock assemblages found in San Mateo County. Appendix D is a discussion of maximum earthquake intensities in San Mateo County, prepared by the U.S. Geological Survey. Appendix E is the Environmental Impact Report for the Element.

The sum total of all these parts is intended to be a comprehensive, innovative planning document designed to meet the widely disparate needs and expectations of all the participating jurisdictions.

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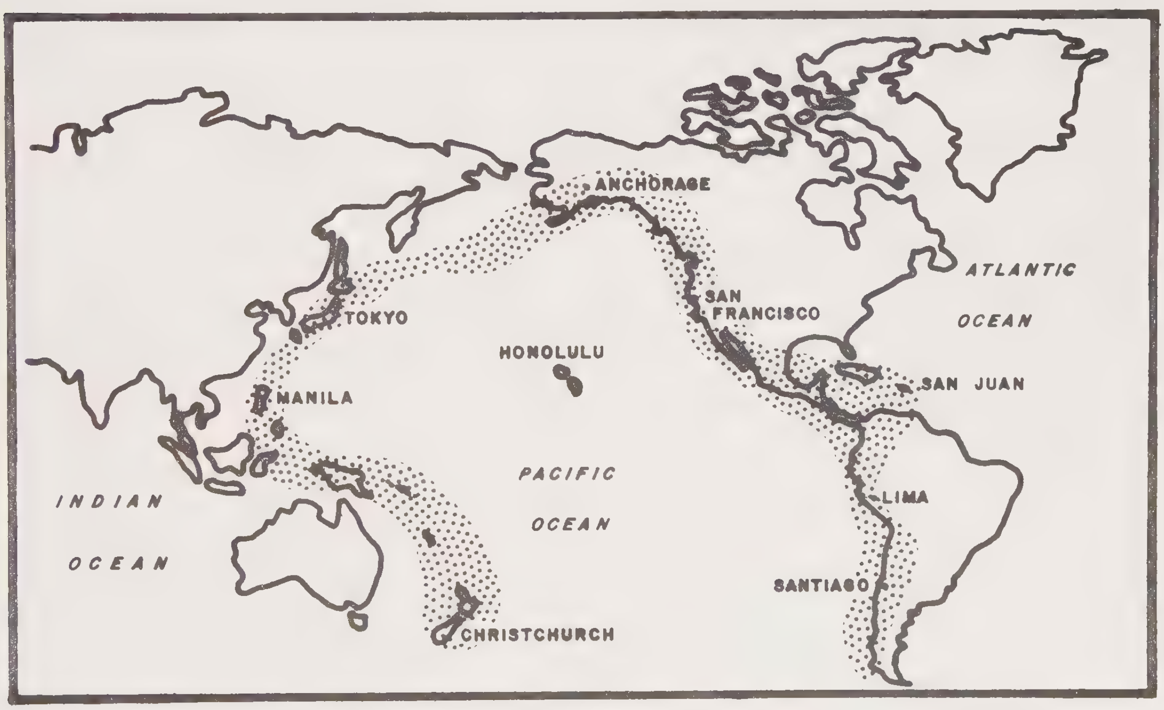
I. INTRODUCTION

INTRODUCTION

The Setting and the Problem

Earthquakes, floods, tsunamis* and seiches* (seismically-induced sea waves), massive landslides, and wildland and urban fires have constituted, over the centuries, most of the major disasters which have befallen mankind (other than warfare, drought, and famine). Even in this day of advanced technology, such catastrophic episodes cannot be readily predicted, wholly controlled, or prevented.

The San Francisco Bay Area and, more specifically, San Mateo County are within the Circum-Pacific Seismic Belt, the relatively small volcanic zone which surrounds the Pacific Ocean and accounts for 80% of the world's earthquake activity (see Figure 1); and as a result, both have histories marked by numerous earthquakes (although San Mateo County has not been particularly troubled by other natural disasters). Over the past 150 years, the Bayside and northern portions of San Mateo County have become densely urbanized, with somewhat less intensive development occurring in the Mid-Coastside area. Thus, the County and its nineteen cities and towns are confronted with the need to consider those public safety hazards associated with not only seismic events, but also other natural catastrophes (e.g., non-seismic geotechnical* phenomena, flooding, inundation from dam failure, and wildland and urban fires) in their planning and decision-making.



Source: California Geology, November 1971

Figure 1

THE CIRCUM-PACIFIC SEISMIC BELT

*See Glossary (Vol. II, Appendix A)

Seismic hazards and attendant concerns are not new to San Mateo County. Traversed by the San Andreas fault, the County has been subjected to two major earthquakes within recorded history: 1838 and 1906. The loss of lives and the value of property damage in these earthquakes were relatively small, due to the low density of development which existed in the County. Were such a major earthquake to occur today, the result would be much different.

The vast majority of the County's 573,900[1] citizens live in relatively close proximity to the San Andreas fault, many on filled baylands, unconsolidated alluvial deposits*, or graded hillsides--and, occasionally, directly on top of the fault trace*.

In addition, many buildings in the centers of the older communities were constructed prior to building code requirements for structural seismic resistance. The residences, businesses, schools, and other public structures in the County are of a wide variety of ages and types of construction, with varying abilities to withstand seismic and other natural hazards. Also, many critical facilities (such as water, sanitary sewers, communications, electricity and gas lines, and circulation routes) have been constructed across fault lines, and are subject to rupture in the event of an earthquake. Thus, the potential for large loss of life, injuries, and significant levels of economic loss due to property damage is great.

The potential problems confronting San Mateo County are by no means unique within the State of California. If significant counter-measures are not taken in the near future, losses in California attributable to geotechnical processes through the rest of the twentieth century have been estimated at approximately $55 billion, with estimates for loss of life ranging into the thousands.[2]

Most of these losses are considered preventable by the California Department of Mines and Geology, through implementation of mitigation measures to reduce the level of risk.[3]

Legislative Mandate

The California State Legislature has mandated that all local governments shall include considerations of seismic hazards and other public safety hazards in their General Plans. Sections 65302(f) and 65302.1 of the Government Code require the following elements to be included in all city and county General Plans:

> A seismic safety element consisting of an identification and appraisal of seismic hazards such as susceptibility to surface ruptures from faulting, induced waves such as tsunamis and seiches. The seismic safety element shall also include an appraisal of mudslides, landslides, and slope stability as necessary geologic hazards that must be considered simultaneously with other hazards such as possible surface ruptures from faulting, ground shaking, ground failure and seismically induced waves.

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1 State Department of Finance, 1975
2 Alfors, et al.
3 Ibid.

A safety element for the protection of the community from fires and geologic hazards including features necessary for such protection as evacuation routes, peak load water supply requirements, minimum road widths, clearances around structures, and geologic hazard mapping in areas of known geologic hazard.

Subsequent legislation mandated that local agencies adopt these elements by September 20, 1974. These provisions interface with other legislation regarding geologic hazards, such as:

Sections 660-662 and 2621-2625 of the Public Resources Code, which require the State Geologist to delineate special studies zones encompassing potentially and recently active fault traces (Alquist-Priolo Act).

Sections 2700-2708 of the Public Resources Code, which require the Division of Mines and Geology to purchase and install strong motion instruments (to measure the effects of future earthquakes) in representative structures and geologic environments throughout the State.

Section 15002.1 of the Education Code, which requires that geological and soil engineering studies be conducted on all new school sites and on existing sites where deemed necessary by the Department of General Services.

Sections 15451-15466 of the Education Code, which require that public schools be designed for the protection of life and property (Field Act).

Sections 15000 et seq. of the Health and Safety Code, which require that geological and engineering studies be conducted on each new hospital or additions which affect the structure of an existing hospital.

Sections 19100-19150 of the Health and Safety Code, which require certain buildings to be constructed to resist lateral forces.

Legislation associated with the Safety Element requirement deals with the duties of the State Office of Emergency Preparedness, dam safety, and fire protection.

Project Organization and Coordination

Inasmuch as seismic and other public safety hazards do not by nature respect jurisdictional boundaries, this project has been undertaken as a cooperative effort between the County of San Mateo, the Towns of Hillsborough, Portola Valley, and Woodside and the Cities of Belmont, Brisbane, Burlingame, Daly City, Foster City, Half Moon Bay, Menlo Park, Redwood City, San Bruno, San Carlos, and South San Francisco. An extension of the 1974 adoption deadline was sought by each of the participating jurisdictions; a new deadline of September 20, 1975 was subsequently

granted by the California Council on Intergovernmental Relations. The determination was also made by the participants that the Seismic Safety Element and the Safety Element should be merged into one program, since an attempt to produce separate but wholly comprehensive documents would lead to substantial redundancy under the State's General Plan Guidelines[4].

Coordinated input was received from the Joint Cities/County Planning Task Force, an advisory subcommittee of the County Regional Planning Committee. The Task Force is comprised of the managers, engineers, and planners of each town and city in the County, and their counterparts from the County staff. In addition, each agency has had a principal liaison staff member who furnished requested technical data to the lead project team in the County Planning Department. Public input was obtained through public hearings and study sessions of the individual jurisdictions.

4 California Council on Intergovernmental Relations, Sept., 1973

II. PURPOSE, GOALS, OBJECTIVES AND CRITERIA

PURPOSE, GOALS, OBJECTIVES AND CRITERIA

Purpose

The Seismic Safety/Safety Element of the General Plan has four purposes: 1) to identify, delineate, and evaluate potential natural hazards, including geotechnical and fire hazards; 2) to identify goals, objectives, policies, and potential implementation programs to reduce risk to an acceptable level; 3) to integrate data on geotechnical and other natural hazards into the decision-making process at the local level, and 4) to give policy guidance to the decision-makers of the participating jurisdictions.

Goals

The goals of the Seismic Safety/Safety Element are:

1. To reduce the risk of loss of life and injuries due to natural hazards;

2. To reduce the risk of loss of property and natural resources, due to natural hazards;

3. To promote the general public welfare, by avoiding or reducing adverse social, economic, and environmental effects of natural hazards;

4. To acknowledge the regional implications of natural hazards and the need for interjurisdictional cooperation in the face of potential disasters;

5. To document the necessary interrelationship between potential land use plans and land capability constraints, arising from the existence of natural hazards;

6. To synthesize earth sciences data and hazard mitigation techniques into the General Plan process.

Objectives

The above-stated goals may be achieved through the fulfillment of the following objectives. The Seismic Safety/Safety Element should:

1. Reduce loss of life, injuries, damage to property and natural resources,and social and economic dislocations resulting from future natural disasters.

2. Serve as a guide for planning decisions relating to the location, density, design, and structural characteristics of new construction, so as to minimize hazards.

3. Serve to indicate where risk to life, limb, and property from natural hazards presently occurs in existing development and to identify factors which will reduce these risks to acceptable levels.

4. Provide a basis for the formulation of criteria to abate natural hazards, recognizing the variable frequency and occurrence of these events.

5. Educate the public regarding natural hazards and potential mitigation of same, and encourage the public to consider risk reduction and emergency preparedness in private-sector decisions.

6. Provide a framework for the initiation of programs to assist the public and minimize disruption of public services in the event of a catastrophe.

7. Establish common parameters for the determination of acceptable risk levels in each participating jurisdiction, while providing maximum flexibility to accommodate differing assessments of risk.

Perceived Risk

Before public policy can address the topics of seismic safety and general public safety, the phenomena of 'risk' (whether in a public or private sense), and its many implications must be examined. Only then can measures to reduce the level of risk be effectively considered by policy makers.

Risk, as defined by Webster's Dictionary[5] is: "the possibility of loss, injury, disadvantage or destruction; the degree of probability of such loss." It should be noted that risk is an expression of negative effect on mankind. Put another way, it is the probable consequences stemming from a future hazardous event.

Risk can be perceived on two levels: individual risk and jurisdictional (or public) risk. This Element primarily addresses the latter concern, although it provides information which may modify an individual's perceptions of risk. Through the process of describing and evaluating the dangers (and risks) inherent in the most commonly experienced natural hazards in San Mateo County, a concensus of risk perception at the community level should emerge. As a result, each jurisdiction should be able to then ascertain which risk reduction measures will best insure the furtherance of the collective public good.

The actual perception of risk is highly personal and subjective, irrespective of whether individual or community risks are being evaluated. It varies due to time, place, occupation, age, previous

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5 Gove, P.B., Webster's Third New International Dictionary (Unabridged), 1971

experience, and numerous other factors, including psychological ones. As a result, risk perception is not something which is wholly rational, but rather is based on feelings and emotional reactions. Thus, it may be very difficult to establish consensus regarding perception of risk levels among a group of people or a community.

The beginnings of a sense of public perception of risk are becoming more and more apparent, especially concerning seismic events. One example of this is the legal mandate for the preparation of the seismic safety element, which was enacted by the State Legislature as a result of the general increase in public risk perception that occurred following the San Fernando earthquake in 1971. Virtually all of the other anti-seismic regulations in existence today also are the results of an increased awareness of public risks following similar events. It is the intent of the Seismic Safety/Safety Element to further the consideration of hazard avoidance and risk reduction <u>prior</u> to a disaster, rather than afterward.

Standards for Risk Reduction

In California, there are several existing public standards for risk reduction, involving both seismic and non-seismic hazards. These safety standards are contained in such codes and ordinances as the Field Act (to lessen seismic risk in school buildings), the Occupational Safety & Health Act, Chapter 70 of the 1974 Uniform Building Code, elevator safety codes, grading ordinances, highway construction standards, fire codes, zoning ordinances, subdivision ordinances, and the State Health and Safety Code. Additional standards may be adopted at the local level as an outgrowth of this Element, in an attempt to more specifically reflect the amount of risk which each participating jurisdiction determines to be 'acceptable.'

Acceptable Risk - Definition and Criteria

In an attempt to assist local jurisdictions in deciding upon programs to reduce risk levels, the California Council on Intergovernmental Relations has advanced the concepts of acceptable, unacceptable, and avoidable risk. These terms have been defined by that body as follows:[6]

Acceptable risk: The level of risk below which no specific action by local government is deemed necessary, other than making the risk known.

Unacceptable risk: Level of risk above which specific action by government is deemed necessary to protect life and property.

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6 California Council on Intergovernmental Relations September, 1973, p. IV-26

Avoidable risk: Risk not necessary to take because the individual or public goals can be achieved at the same or less total "cost" by other means without taking the risk.

The determination of what constitutes acceptability and unacceptability is highly subjective.

There are six discrete criteria which are offered as the primary bases for making such a judgement:

1. Community Risk Perception. Any evaluation of relative risk levels associated with specific hazards needs to involve not only the decision-makers of each jurisdiction, but also, to the greatest degree possible, the community as a whole.

2. Hierarchy of Risks. Depending upon the range of land uses present and the perception of risk found in each jurisdiction, certain categories of land use will be deemed as having greater safety needs than others. For instance, facilities such as nuclear reactors and large dams could cause widespread destruction if they were damaged; therefore, the need to decrease the risk exposure of these facilities is very great. Critical lifeline facilities generally follow in the hierarchy, succeeded by high-occupancy public uses (e.g., schools, churches, auditoriums, theaters, large hotels, and civic buildings). Commercial and industrial uses usually follow these, with residential uses and non-structural uses usually at the lowest end of the hierarchy. Again, community involvement in the discernment of the hierarchy of risks is critical.

3. Severity of Potential Losses. Associated with each category of land use is a certain potential for losses in terms of deaths, injuries of varying severity, property damage, loss of function (especially critical when involving public utilities), and hidden, intangible social costs. The potential scale of such losses on a community-wide basis needs to be evaluated.

4. Supportable Loss Level. The ability to tolerate a certain level of loss is implicit in any discernment of relative amounts of risk. This should be evaluated, with wide public participation, regarding all of the differing ways of experiencing loss. It should be noted that any amount of death is usually deemed intolerable, and therefore unacceptable.

5. Probability of Loss. The likelihood of the occurrence of hazardous events needs to be estimated and reviewed with respect to amount of tolerable loss over a given time frame. The susceptibility of structures, lifelines, and human activities to intolerable losses needs to be evaluated. The adequacy of basic hazard data is an important factor in this regard.

6. Risk Reduction and Mitigation Capability. The availability of reasonable means to reduce and/or mitigate risk exposure needs to be addressed and evaluated by each jurisdiction with respect to current technological capabilities, intrinsic and social costs and benefits, availability of fiscal resources and personnel, and governmental prioritization.

The application of these six criteria will lead each of the fifteen jurisdictions which are participating in this Element to different determinations of what constitutes 'acceptable risk', in conformity with the guidelines from the California Council on Intergovernmental Relations (CIR). The ultimate expression of a local jurisdiction's perception of 'acceptable risk' is the policies and implementation measures which it adopts. In this manner, each jurisdiction achieves compliance with the CIR guidelines on risk, noted previously.

III. ISSUES

ISSUES

COUNTY-WIDE ISSUES

Geotechnical Issues Relating to Seismicity

There are numerous natural hazards in San Mateo County. Perhaps the most grave hazard throughout the entire County arises from the existence of the three active* faults which traverse the Peninsula: The San Andreas fault, the Seal Cove-San Gregorio fault, and the Serra fault.

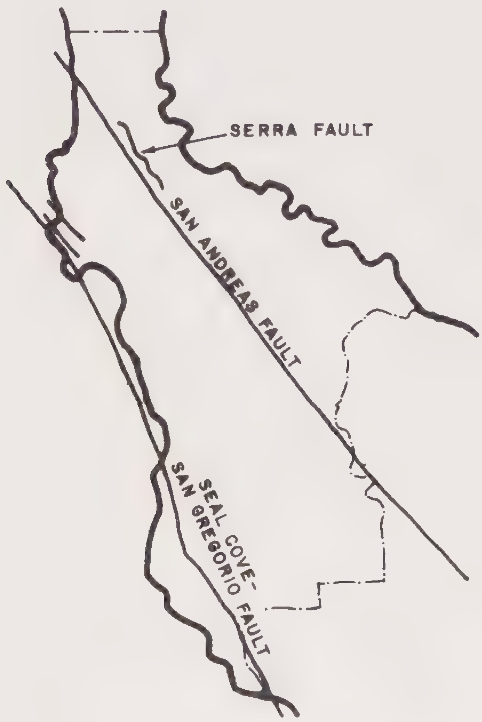

Figure 2

ACTIVE FAULTS IN SAN MATEO COUNTY

The potential for intense ground shaking associated with Richter magnitude 5.0 or greater earthquakes on these faults is significant, especially along the San Andreas fault. The absence of tectonic creep* (or small, constant movements) along the San Andreas indicates that this fault is locked throughout San Mateo County, allowing crustal strain* to build up. The

* See Glossary (Vol. II, Appendix A)

natural method for releasing this strain is an earthquake; the longer the period of build-up, the larger the earthquake is likely to be. Many geologists feel that the San Andreas fault is 'overdue,' and that the resultant ground shaking will be very severe. Ground shaking is the major cause of damage in any seismic event.

An associated hazard is the potential for surface rupture*. The fact that the Serra fault, the Seal Cove (and its related unnamed traces), and the northerly portion of the San Andreas fault all traverse moderate to high density urban areas heightens the risk factor to people, structures, and lifeline* facilities.

Various types of ground failure also constitute geotechnical issues in San Mateo County, including landslides, subsidence* and liquefaction*. Within the hill areas, especially in the unincorporated South Coastside area, landslides constitute a large common hazard. Ground failure of this nature can be caused not only by seismicity, but also by groundwater problems and/or man-made alterations to land.

Subsidence and liquefaction are two other hazards of major significance which are directly related to seismicity. Occurring predominantly in areas where the soil is loosely consolidated, subsidence occurs when ground shaking causes the material to compact through vibration. Liquefaction, on the other hand, may be expected in those areas where Bay Mud is underlain by clean, saturated layers of sand. Essentially, when these sediments are subjected to ground shaking, they turn into a liquefied state. If this phenomena occurs near the surface, it may cause structures to lose foundation support. It should be noted that the unconsolidated sediments* involved in both phenomena may tend to amplify the amount of ground shaking, so that an earthquake with a given Richter magnitude can be expected to cause a greater intensity of ground shaking in those areas where sediments of this type are present.

Two other seismic hazards which will have localized effects are tsunamis* and seiches* (seismically-induced waves). Tsunamis can be expected to affect the coastal areas (the baylands to a lesser extent). Seiches present a hazard to shoreline development around lakes and reservoirs.

<u>Non-Seismic Geotechnical Issues</u>

There are several non-seismic, geotechnical issues confronting San Mateo County. As indicated above, landslides are not always associated with seismicity, but rather with groundwater and/or land alterations. Thus, landslides present a nearly constant problem, even during periods of very little seismic activity. Losses due to landslides increase as a direct function of population growth in areas of high landslide susceptibility.

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*See Glossary (Vol. II, Appendix A)

Localized non-seismic hazards which are present in one or more areas of the County include coastal instability, erosion, and expansive soils*. Each of these problems, where present, may constitute a significant safety issue, inasmuch as the damage consequences of each can be quite severe. Subsidence, another localized problem, can also be a non-seismic hazard in instances where settlement occurs as a result of draw-down of the water table.

There are various hydrological problems which also present County-wide issues. Flooding from excess surface run off is the most important hydrological hazard in most areas. Often, this problem is heightened by the relative inadequacy of flood control works; in places, undersized culverts actually contribute to the flood hazard.

The potential for inundation resulting from dam failure is a significant safety issue to development which lies downstream from the County's twenty dams. Dam failure can be due to foundation failure (from ground shaking, erosion, subsidence, and/or liquefaction), inadequate spillways, and inadequate design and construction.

<u>Catastrophic Fire</u>

Urban and wildland fire* constitute the final significant safety issue in San Mateo County. Urban fire may also be associated with explosive materials and/or the release of noxious fumes which, if dispersed by air currents, could endanger the health of large populations. The hazard from wildland fire is extreme in the hills and the southern parts of the County, where dense vegetation occurs.

<u>Structural Hazard Issues</u>

Hazards associated with structures are related to several factors: age of structure, type of construction (both material and technique), and use. Buildings constructed before 1933, when anti-seismic provisions were added to building codes, present significant potential hazards, as do unreinforced masonry buildings. Certain other types of structures, built between 1933 and 1948, may also present hazards, since they were built before anti-seismic design was incorporated uniformly throughout the building code. Occupancy loads and the approximate hours when a building will be inhabited make structural use an issue in potentially hazardous buildings. Generally, public schools and 1-2 story wood-frame single-family residences present the least risks to individual safety.

<u>Issues Relating to Lifelines and Essential Services</u>

There is a significant potential that a major earthquake will severely disrupt such lifeline* services as: electricity, gas,

*See Glossary (Vol. II, Appendix A)

water, sewage treatment, communication systems, and such transportation networks as highways, railroads, airports, and port facilities. Essential services may also be disrupted, including fire and police protection, and the provision of emergency medical care. The potential for disruption is increased by the fact that many of these cross one or more active faults (and thus may be damaged by ground rupture) or are located on sediments with moderate to high potential for liquefaction, subsidence, and/or amplification of ground shaking. The maintenance of these lifeline and essential services is a very significant safety issue.

Specific Hazards and Issues

The foregoing hazards are all discussed in much greater detail in the Technical Supplement (Volume II). All of the geotechnical hazards enumerated above (i.e., everything except urban and wildland fire) are also spacially represented for the entire County on the Geotechnical Hazards Synthesis Maps, contained in the map folder which accompanies this volume. A statement regarding the use and limitations of these maps is also included in the folder.

In addition to the macro-hazards indicated in the foregoing section, there are particular hazards which are encountered locally within each jurisdiction. These are enumerated in the subsequent sections of this Chapter. It should be noted that the technical issues confronting those communities which have nearly completed their development will be perceived in a different manner than by those jurisdictions which are still expanding and developing. This variance in issues perception will strongly influence the resultant choice of policies and implementation programs.

SPECIFIC ISSUES FOR THE CITY OF BELMONT

Liquefaction*, strong ground shaking, flooding, and landsliding are major geotechnical concerns within the City Limits of Belmont. Landslides, which are considered to be the City's biggest problem, are known to exist in the area west of El Camino Real (with maximum dimensions of 50 to 500'). These slides are principally found in Franciscan assemblage rocks, which are locally expansive where sheared shale is known to exist. These slides, even though currently stabilized, may be activated in the event of a major earthquake.

Several faults exist within the City Limits, which are considered to be inactive due to evidence indicating no movement in geologically-recent time. However, due to the close proximity of the San Andreas fault zone and the Serra fault, strong ground shaking within the City is a hazard. According to Borcherdt and Gibbs (1975), strong ground shaking intensities associated with a major earthquake will result in damage to masonry and foundations, with structures lurching from poorly pinned or weakened foundations. Many chimneys can be expected to sustain moderate to severe damage. Ground shaking will be strongest within the Bay Mud areas, (see Note, below), principally east of the Bayshore Freeway, where shear wave amplification* will be enhanced due to the poorly consolidated to unconsolidated nature of the soil. Liquefaction* may also be anticipated in this area, due to the liquefying of saturated,* clean sand lenses. On the undeveloped fill area adjacent to Marine World, formations for future development should be designed with this in mind.

Flooding along Belmont Creek is a major problem. Three areas are effected and may sustain extensive property damage: near Alameda de las Pulgas and Ralston Avenue, near Belmont Hills Sanitarium, and from Sixth Avenue to the Bayshore Freeway (where most of the damage will occur within the business and industrial areas, and in a small segment of the residential sector). Portions of Belmont will also flood due to heavy run-off along Laurel Creek.

Safety concerns within the City of Belmont include the following: structural hazards, inadequate emergency access in some portions of the City, high potential for both wildland and urban fires, inadequate hydrants in four locations, low water pressure in two locations, and the potential for culverts being damaged and/or destroyed.

NOTE: The term Bay Mud is meant as geologic unit in this instance, not as geographic unit implying current involvement with the Baylands, themselves.

*See Glossary (Vol. II, Appendix A)

Structural hazards are confined primarily to pre-1933 buildings and, in some cases, structures built between 1933 and 1948. Many of these are located in the central area of the City. While all public schools in Belmont meet the requirements of the Field Act, the privately-owned College of Notre Dame and adjacent high school may constitute a significant hazard in a seismic event (especially Ralston Hall, built of unreinforced masonry which, however, survived the 1906 quake without major damage).

Inadequate emergency access is another problem in Belmont, primarily due to numerous streets which provide only one ingress-egress. The following areas are deemed hazardous in this regard: Solana Drive, Escondido Way, the Plateau-Lower Lock area, and Skymont Avenue. Evacuation in these areas and/or getting emergency vehicles into them in the event of a catastrophe could prove difficult if the limited access points were blocked.

High catastrophic* fire potential exists within Belmont also. The areas affected by high brushfire hazard are the western hills, around existing developments such as Belmont Heights/Knolls, Plateau, and Skymont, as well as Belmont Creek Canyon. The area behind the Belmont Hills Sanitarium also constitutes a high fire hazard. Urban sources for catastrophic fire include structural fires involving older wood frame structures. Buildings with shake roofs serve to increase the level of risk in high fire hazard areas. Another urban source of risk is the storage of dangerous materials in the industrial area. The possibility for severe property damage and/or loss of life and limb is significantly raised by inadequate hydrants and/or water pressure. Four streets are involved in the first problem: Bay View Avenue, Hillman Avenue, Terrace Drive, and Semeria Avenue. In addition, two areas suffer from low water pressure: the upper end of Hill Street and the end of Pine Knoll Drive.

The last safety concern confronting Belmont is the danger of collapsed or damaged culverts in the event of a strong earthquake. This includes not only culverts in streets (which may result in loss of emergency access), but also culverts under structures. Critical culverts include the creek channel in Carlmont Drive, the box culvert in Sixth Avenue, and the one at Carlmont and Alameda (which would hamper emergency vehicles from the area).

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*See Glossary (Vol. II, Appendix A)

SPECIFIC ISSUES FOR THE CITY OF BRISBANE

Expansive soils,* slope instability, liquefaction,* and strong ground shaking are the major geotechnical hazards within the City of Brisbane.

Much of the lower slopes within Brisbane are potentially expansive and unstable. Some active landslides are present as is evidenced by the landslide west of the U.S. Highway 101, near Sierra Point. At least one landslide has been known to exist as a result of seepage from a redwood water tank. Expansivity and slope creep* within the colluvium* have caused foundation problems in structures built on the lower slopes of San Bruno Mountain; however, no homes are known to have been lost due to landslides.

Strong ground shaking is anticipated within Brisbane in the event of a large-magnitude earthquake along the San Andreas fault zone. Liquefaction, landsliding, and failure of the City's three redwood water tanks can be anticipated as a result of strong ground shaking. Shear wave amplification* within the Bay Mud may increase the liquefaction potential of the saturated* incorporated sand lenses, which will result in moderate to severe damage to the Southern Pacific Railroad yard and the freeway.

Saturation resulting from leakage into the soils underlying the City's redwood water tanks may have weakened the shear strength of the soil. This soil, in this condition, could readily fail in the event of strong ground acceleration, resulting in collapse of the water tanks. Surficial soil failures may also occur in the colluvium during an earthquake, which could cause extensive damage. Numerous springs above Kings Road indicate a high or perched water table* and saturated soils, enhancing the instability problem.

Development of old dumpsites within the City also causes potential problems, in a geotechnical sense.

Safety issues and concerns for the City of Brisbane include: catastrophic fire,* very limited access, poor circulation within the City, inadequate ambulance response capabilities, underground fire hazards, the presence of explosive materials and noxious substances, and hazards from damaged utility systems.

Catastrophic fire hazards stem from two sources: grassland fires from San Bruno Mountain, and large-scale structural fires from the relatively high concentration of older wood-frame structures. These hazards are mitigated to a degree by the recent completion of a HUD-financed hydrant construction program.

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*See Glossary (Vol. II, Appendix A)

Access and circulation problems not only compound the catastrophic fire situation, but heighten the hazards associated with geotechnical events (most especially, severe ground shaking). Currently, there are only two entrances to the residential section of the City of Brisbane -- Old County Road and San Bruno Avenue. Emergency access may be gained through neighboring Crocker Industrial Park, or, in extreme cases, by grading auxillary access points from the City directly onto Bayshore Highway.

Access to other portions of the Peninsula will be severely impaired in the event of an earthquake, since the Bayshore Freeway and its one Brisbane access point will probably be destroyed or damaged. Access to hospitals (Kaiser in South San Francisco, Peninsula Hospital in Burlingame and Mary's Help in Daly City) will be limited by this fact, with Mary's Help (reached via Guadalupe Canyon Parkway), being the most probable available facility.

Circulation problems within the City stem from three factors: narrow streets (15-16 foot without parking, 18-20 foot with parking), oblique intersections where sight distance is low and manuevering space is at a premium, and a circuitous road pattern. This latter problem is heightened by the fact that many potential connectors are actually just 'paper streets' (i.e., existing only on maps and plans). As a result, there are many long cul-de-sacs in the City which, if blocked, could effectively stymie any rescue and/or evacuation attempts. Only one access point exists to the tank farm area. A bridge across railroad tracks is also vulnerable in a seismic event.

Inadequate ambulance response capability has also been identified as a major concern. Ambulance service for the City is contracted, by the County, to private firms under an emergency services agreement. However, the firms which cover Brisbane are apparently unfamiliar with the layout of the City, so that the citizens feel that service is unreliable.

Underground fire hazards also exist, due to the aforementioned presence of old dump sites within the City which have since been covered over. The presence of flammable material (including old rubber tires), as well as the generation of methane gas from the decomposition process, creates substantial underground fire hazard, with a concomitant danger of explosions. The release of noxious chemicals and danger from explosion and/or catastrophic fire also exist with respect to the following facilities, all of which are located in the City of Brisbane:

1. <u>Southern Pacific Tank Farm</u> - diesel fuel and jet fuel. One 12" line comes into the tank farm from Oakland, and two 8" lines exit the tank farm, one carrying diesel fuel to the Southern Pacific Round House and the other carrying jet fuel to San Francisco International Airport;

2. Van Waters & Rogers (Chemical Warehouse and Tank Farm) - Storage of 177.1 thousand gallons of thinners and chemicals at the tank farm, and storage of many varieties of "red label" substances in the warehouse;

3. Valley Drive - three warehouses specializing in paint storage and mixing;

4. Pargas Company - Storage of 15,330 gallons of bulk propane and 13,000 containers of propane;

5. Southern Pacific Train Yards - transportation of hazardous materials, including corrosives and other chemicals (train yard assembles trains for transshipment nation-wide).

The disruption of utility services constitutes additional hazards. Risk to life and limb could occur from the following events: downing of powerlines within the City due to antiquated poles, damage to the 220 KV buried electrical transmission cable (oil cooled) which runs under Bayshore Boulevard, rupture of the pressure sewage line from Valley Drive along Bayshore Boulevard to San Francisco, and rupture of two Hetch-Hetchy water lines (44" and 60") that pass through Brisbane.

SPECIFIC ISSUES FOR THE CITY OF BURLINGAME

Geotechnical concerns for the City of Burlingame are landslides, faulting with surface ruptures, liquefaction potential,* expansive soils,* flooding, and tsunami* inundation.

Landsliding, potential landslides, and expansive soils are known to exist within the Franciscan rocks and Merced Formation underlying the City. Highest potential for slope stability problems is found in the underlying earth units of Buri Buri Ridge, in the residential section of the City. Both field work and aerial photointerpretation show that these slides are commonly 50' to 500' in maximum dimension.

With the Serra fault lying within the City Limits and the San Andreas fault zone in close proximity to Burlingame (both with evidence of movement in recent geologic time), the City of Burlingame has a potential for experiencing significant ground shaking. In the event of a large-magnitude earthquake, ground acceleration may activate existing landslides, rupture municipal utility services, and cause local liquefaction where saturated* sand lenses are incorporated within the Bay Mud. According to Borcherdt and Gibbs (1975), Burlingame will experience "Grade A - Very Violent" to "Grade C - Very Strong" intensities of ground shaking in the event of a major earthquake on the San Andreas fault.

Flooding and tsunami are other geotechnical hazards. Flooding, including dam inundation, will principally affect the lower elevations of the City (see the Geotechnical Hazards Synthesis Maps). Areas that will be affected most severely are the industrial areas adjacent to the Bayshore Freeway and those on fill within the Bay Mud areas. Tsunamis can be anticipated to inundate the lower Bay Mud area, east of the Bayshore Freeway. Inundation is anticipated to not exceed an elevation of five feet, with a mean recurrence of 200 years. This would principally affect the sewage disposal site, drive-in theater and some industrial buildings.

Safety issues in Burlingame are diverse. Public safety may be endangered by the failure of older commercial and industrial structures, especially those constructed prior to 1933 (although relatively intense risk to life and limb is associated with apartments and hotels of the same vintage--especially if they are taller than two stories, or of other than wood frame construction). While Burlingame fire protection is exemplary, some structural fire hazard exists, due to two factors: potential lack of availability of fire equipment east of the Bayshore Freeway (should all access across the Bayshore Freeway be damaged or destroyed in a major seismic event), and the low water pressure in the central portion of the City, due to the fact that old water mains have not yet been upgraded.

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*See Glossary (Vol. II, Appendix A)

Another safety issue is the potential for fire in the relative inaccessible Mills Canyon area.

Circulation may also become a safety issue in the event of a major earthquake. Structures associated with Interstate 280 and Highway 101 may be expected to be severely damaged and/or destroyed. In addition, culverts across creeks may be damaged and/or destroyed. However, California Drive, which parallels the railroad tracks, will provide an alternative route for through traffic, in addition to El Camino Real.

SPECIFIC ISSUES FOR THE CITY OF DALY CITY

Several geotechnical hazards are present within Daly City. The three most important are landsliding (along the Pacific Coast bluffs), faulting with surface rupture (along the San Andreas fault zone), and liquefaction potential* in the northeastern portion of the City.

Landsliding and potentially expansive soils have already caused extensive damage and the removal of homes. Several homes are being threatened along the 900 block of Skyline Drive, where an active slide exists at the edge of the cut and cover sanitary land fill. An additional 12 homes have been removed in recent times from Westlane Drive, within the San Andreas fault zone. In addition, 7 dwellings in the 100 block of Westlake Drive are currently in danger, along with a substantial section of street, which requires regular repair. A landslide of major proportions exists along the San Andreas fault trace at Fog Gap. Further north, approximately 2 miles away, 4 houses have recently been removed from Lynvale Court and the most northerly extension of Skyline Blvd., an area adjacent to Thornton Beach State Park.

Earthquake damage is anticipated to be severe to moderate in the event of a major quake on the San Andreas fault. 'Very violent' intensities are expected along the San Andreas rift zone where surface rupture is expected (Borcherdt and Gibbs, 1975).** Approximately 869 single-family dwellings exist within a 2,000 foot band adjacent to the San Andreas fault zone, most of which may be expected to sustain severe damage or be totally destroyed. This area also includes a neighborhood commercial shopping center, which can expect substantial damage. All municipal utilities will, most likely, be severed. Local subsidence* along the fault zone is anticipated, as was witnessed during the 1906 earthquake. Liquefaction potential in the western portions of the City is low to moderately-low and will be localized in areas underlain by clean, saturated sands (restricted to the vicinity of Westlake and the Lake Merced Country Club).

Geotechnical hazards in the northeast part of the City, in the vicinity of the Cow Palace are liquefaction and slope instability. Colma Valley sustained extensive ground failure due to liquefaction in the 1906 earthquake. The liquefaction potential is low to moderate and may occur locally within the flatter lands. Slope instability is related to expansive clays and clayey silts within the colluvium* on the lower portions of the slopes. The colluvium is also subject to creep* under the influence of gravity, especially when saturated during the rainy season. Existing colluviums*, especially in the vicinity of Pacific Manor and the Pacifica boundary, are potentially expansive and may cause foundation problems. Perched water is an associated problem from the standpoint of seepage and soil considerations.

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*See Glossary (Vol. II, Appendix A)

**See Vol. II, Appendix D

SPECIFIC ISSUES FOR THE CITY OF FOSTER CITY

Geotechnical issues within the City of Foster City are: strong ground shaking, ground failure due to liquefaction,* inundation by tsunamis,* inundation from dam failure, and possible subsidence.* This unique city is built upon controlled fill underlain by Bay Muds. The area is protected by an engineered fill dike.

Foster City can expect strong ground shaking during an earthquake because the underlying Bay Muds and thick sequence of alluvial deposits tend to amplify seismic waves. The long-period motion components will be amplified the most, but these waves are the least damaging to low structures, the type most prevalent in Foster City.

The most important concerns regarding ground stability deal with dike stability, ground failure due to liquefaction, and massive underwater landsliding. Extensive investigations have been conducted regarding the capability of the dike system. Studies have been made to establish adequate dike height to prevent overtopping from severe natural conditions (high tides, storms, etc.) and to assure dike stability in areas where dikes have been developed over former sloughs. A continuous dike maintenance program has been developed and is being implemented.

Subsurface data available for the Foster City area (Dames and Moore, 1960) indicate the apparent absence of potentially liquefiable, continuous sheets of sand within the Bay Mud deposits. The characteristics of the Bay Mud and recent alluvium beneath Foster City may be similar to those of the Redwood Shores area, where the liquefaction potential has been extensively studied and assessed as "low" by the project consultants and the Redwood City Seismic Advisory Board. Further detailed investigations specifically of the liquefaction hazard of Foster City are advisable prior to major new development within areas underlain by permanently saturated deposits, especially the Bay Mud. The scope of such liquefaction hazard studies depends upon the concept of acceptable risk and the importance factor associated with the particular development involved.

The hazard to the stability of dikes from liquefaction likewise is presently considered to be minimal. Nevertheless, careful monitoring of the dikes, particularly following strong earthquakes, will be an integral part of the continuous dike maintenance program.

The effects of massive landsliding can only apply with reference to the main Bay ship channel which is located more than 3000 feet to the northeast. The ship channel, which is about 50 feet deep, is far enough removed from the dike system that the occurrence of a slide would not affect the dike system. Belmont Slough is not considered deep enough to create mass movement or close enough to threaten the dike.

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*See Glossary (Vol. II, Appendix A)

Inundation by tsunamis is possible (Ritter and Dupre, 1972) but highly unlikely. It has been estimated that a tsunami with a coastal runup of 20 feet at the Golden Gate would attenuate to a height of 5 feet at Foster City, an event which has a mean recurrence period of 200 years. This amount of water would overtop the dikes if the event occurred when the tides were in excess of +4.5 feet (top of dike is +9.5 ft. above sea level). The normal tide range is -4.095 to +2.334 feet. Overtopping could cause flooding within Foster City. However, the extent would depend upon the amount of overtopping. Seiches within the Foster City lagoons are a negligible hazard.

Inundation of Foster City from the failure of San Andreas and Crystal Springs dams is a possibility, although remote. The methods used in computing such an occurrence are based upon assumptions which result in a maximum situation. Since the dam inundation map used as the data base in this study is oriented toward emergency preparedness planning, without qualifications as to depth, velocity of water, duration of inundation, or even the probability of such a maximum occurrence, planning considerations for such an event cannot reasonably be applied without more substantial study and data. Therefore, at this point, such a hazard must be recognized as a possibility, but cannot be predicted without considerable qualification.

Subsidence due to ground shaking is expected to be relatively minor due to the stability of the engineered fill. Substantial study has been done regarding such conditions and significant requirements have been introduced into building regulations to accommodate differential settlement.

Safety issues for Foster City are confined to three major problems: access and circulation, acute medical care, and utility disruption. Access and circulation problems have a common denominator -- the dependence of the City on bridges and culverts. Ingress and egress to Foster City is gained at four points: Third Avenue, 19th Avenue, Hillsdale Boulevard, and the Hayward-San Mateo Bridge. All of these approaches involve, at some point, crossing water. In the event of a major earthquake, the City may be effectively cut off from the rest of the Peninsula if these four approaches are significantly damaged and/or destroyed. There is also a great potential for interior disruption within the City, due to the same problem. This problem is mitigated to some extent by the fact that some of the water bodies are quite shallow and can be waded across. Many of the residents of Foster City also have boats.

Geographic isolation will create a concomitant problem -- provision of acute medical care on an emergency basis. Without provision of mobile hospitals or similar facilities, isolation may endanger the lives of those injured in a catastrophe, as well as increase the duration of human suffering.

Another safety issue is the potential disruption of utilities. Although the lifeline systems have been specially designed to tolerate some ground shaking, there remains the definite hazard of system disruption. When coupled with the isolation potential, the need for Foster City to develop a strong self-sufficiency becomes apparent, inasmuch as repairs to utility systems will be delayed due to lack of access. The most critical concern involves the provision of potable water.

SPECIFIC ISSUES FOR THE CITY OF HALF MOON BAY

Geotechnical hazards within the City Limits of Half Moon Bay are liquefaction potential,* ground shaking enhancement due to the unconsolidated and moderately-consolidated nature of the earth materials, coastal bluff instability, tsunamis,* flood, and inundation from dam failure. Coastal bluff stability problems and tsunami inundation are restricted to the coastline. Tsunami inundation can also be expected approximately one mile up Pilarcitos Creek. Flood inundation is restricted to Pilarcitos Creek, broadening slightly at the creek mouth. Liquefaction potential is low to moderate and restricted to alluviated channels and flat lands with a high water table and underlain by unconsolidated sands. Low coastal bluff stability exists in the northern part of the City, as evidenced by the cliff retreat seen along Mirada Road, and stability increases southward. Dam inundation can be expected along Pilarcitos Creek in the event of the failure of the dam at Pilarcitos Lake (see the Geotechnical Hazards Synthesis Maps).

Safety issues for the City of Half Moon Bay include moderately high fire hazard, limited evacuation routes, and the relative unavailability of local acute medical care facilities. The catastrophic fire hazard stems from not only brush fire, but also that associated with eucalyptus groves near and around the City. This hazard is escalated by the presence of a high concentration of older, wood-frame structures toward the center of town.

Evacuation routes in the event of a catastrophe are limited to three possibilities: Highway 1 - North, Highway 1 - South, and Highway 92 (San Mateo Road)- East. In terms of reaching the Bayside population centers, the first and third routes may prove impassible due to landslides. The Highway 1-South route should probably prove passible, except for high-risk points such as culverts and bridges. However, the areas surrounding eastbound roads, south of Half Moon Bay, also have a high landslide potential, which could result in effectively cutting off access to the coastside. Isolation from the rest of the Peninsula could be critical, inasmuch as the Mid-Coastside has virtually no acute medical care capability. However, on an emergency basis, it is possible that Moss Beach Rehabilitation Center could be used for limited medical care. Access problems also heighten the possibility that the Mid-Coast may have to go without basic utility service longer than the rest of the Peninsula, and thus the Coastside should perhaps strive for greater self-sufficiency.

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*See Glossary (Vol. II, Appendix A)

SPECIFIC ISSUES FOR THE TOWN OF HILLSBOROUGH

Geotechnical concerns within the Town of Hillsborough are landslides, expansive soils,* severe ground shaking and surface rupture, and inundation from dam rupture. A small area in the northeast section of Hillsborough may be subject to flood inundation, according to the Federal Flood Insurance Maps (but not according to the source utilized for the Geotechnical Hazards Synthesis Maps). This latter designation is currently under reconsideration.

The western portion of the Town of Hillsborough is underlain with serpentine and sheared rocks of the Franciscan assemblage, resulting in relatively unstable slopes with a moderate potential for landslides (refer to the Geotechnical Hazards Synthesis Maps for a more complete description). The largest concentration of slope instability is along the southern side of San Mateo Creek, where the Franciscan sandstones have clay lenses and seams. This soil becomes expansive when wet and may cause serious foundation problems. As a result, most of the homes in this area have been built on piers. Actual landslides within the Town have been generally limited to a few of the 'backyard' variety, which have been corrected. In general, hillsides within the Town tend to be very steep and highly erosive when disturbed. In the westerly portion of the Town, a high water table (4-5 feet) is associated with the serpentine areas, and subsurface drains have been deemed necessary in the Lakeview, Unit 2, subdivision. Surficial* run-off is very good.

The inclusion of a portion of the Serra fault within the Town's incorporated limits, and the proximity of the San Andreas fault, presents a high potential for surface rupture and strong ground shaking. Moderate to severe damage can be anticipated, as well as the potential failure of the Crystal Springs Reservoir dam. The resultant inundation would follow the course of San Mateo Creek and would cause severe property damage, as well as peril life and limb. Inundation may also result from the rupture of the Crocker dam, which retains the 30 acre-foot Crocker Lake. The inundation pattern in this case would follow Sanchez Creek. Intensities of ground shaking can be expected to be from 'very violent' to 'very strong' (San Francisco scale, Borcherdt and Gibbs, 1975) with the most severe ground shaking adjacent to the fault and throughout much of the City.

Safety issues for the Town of Hillsborough are confined primarily to catastrophic fire, access for emergency vehicles, and the potential for bridge collapses over San Mateo Creek. The potential for brush and forest fire is significant in the canyon areas and along Interstate 280. However, potential risks are, in part, mitigated by a mutual aid pact with surrounding jurisdictions and a good hydrant system. Average road widths of 20 feet may inhibit access for emergency vehicles, however, in the event of a catastrophe.

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*See Glossary (Vol. II, Appendix A)

Similar problems may arise if bridges over San Mateo Creek are damaged or destroyed.

Coordination of emergency services may be substantially impaired in the event of an earthquake, since the hub for such activities is the City Hall, which was built in the 1920's and is thus considered to be a high risk building. However, some services, including police, are housed in a 1949 addition which has a substantially lower risk factor. All four public schools meet the requirement of the Field Act; the two private schools are housed in Class A concrete buildings which meet all of the State Architecture Board's requirements for public safety.

Access to emergency medical facilities (Peninsula Hospital in Burlingame and Mills Hospital in San Mateo) is adequately diverse to prevent any portion of the Town from being cut off. Access to Interstate 280 may be expected to be damaged or destroyed in the event of an earthquake.

SPECIFIC ISSUES FOR THE CITY OF MENLO PARK

Major geotechnical constraints for the City of Menlo Park include liquefaction potential,* ground shaking intensity, expansive soils,* landslides, floodprone areas, and inundation from dam failure.

The bayland areas are most susceptible to liquefaction, in that this region is underlain by weakly consolidated Bay Muds and incorporated sand lenses, saturated* by a high groundwater table. Tsunami* inundation potential is moderate and will effect, principally, the currently undeveloped marshlands. Due to the fact that the area is at the southern end of the Bay, damping of the tsunami should dissipate much of the energy prior to inundation and, therefore, damage will probably be minimal. Flood run-off in the event of a 100-year storm can be expected to inundate most of the baylands.

The central portion of the City has a low to moderately-low liquefaction potential and will be subject to 'very strong' ground shaking intensities (San Francisco scale, Borcherdt and Gibbs, 1975) in the event of a major earthquake. The area is underlain by older, weakly consolidated sands and gravels with a high water table. The southeast portion of the central part of Menlo Park, adjacent to East Palo Alto, is subject to flooding in the event of a 100-year storm. The Palo Alto and Stanford faults transect the central portion; however, these faults are considered to be inactive and are overlain with more recent alluvial sediments. No movement is anticipated along either of these faults.

The Sharon Heights portion of Menlo Park is subject to strong ground shaking, landslides, and soil creep* and is known to have two existing landslides. Expansive soils in Sharon Heights have a high shrink-swell potential and are subject to seasonal soil creep (Fleming and Johnson, 1975). Dark soil derived from claystone is consistently 4'-6' thick and has cracks up to 2 inches wide during the dry season.

In the event of the failure of the dams at Bear Gulch Reservoir and/or Searsville Lake, the resultant inundation will affect the northern and southern portions of the City, respectively.

Safety issues in Menlo Park include potential temporary isolation of the Sharon Heights area and Belle Haven, possible collapse of bridges, damage to San Francisco water lines traversing the City and culverts in a major earthquake, structural hazards, and the threat of urban catastrophic fire associated with the industrial area.

The potential for emergency access problems relating to Sharon Heights and Belle Haven is significant. Both areas rely on a limited number of ingress-egress routes, which, in the event of a

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*See Glossary (Vol. II, Appendix A)

catastrophe, could become blocked, preventing provision of emergency services or the evacuation and/or rescue of people in those areas. Additional circulation problems may arise should bridges over the San Francisquito Creek be severely damaged or destroyed. A similar problem exists with the storm drain under Alameda de las Pulgas. In addition, potential failure of the Dumbarton Bridge and structures involving Interstate 280 and Highway 101 would substantially reduce access into the City. A corollary of this problem is that Menlo Park could be effectively cut off from acute medical care facilities, located across San Francisquito Creek at Stanford Hospital. However, this problem is mitigated to some extent by the availability within the City of the Veterans Administration Hospital, eight convalescent hospitals and rest homes, and one medical clinic.

Structural hazards are chiefly associated with buildings constructed prior to 1933, particularly if they are of unreinforced masonry. Buildings constructed between 1933 and 1948 may also prove hazardous, with wood-frame structures generally excepted. Portions of the central area of Menlo Park, its older churches, St. Patrick's seminary, and the Veteran's Administration Hospital may constitute potential hazards in need of further examination.

The threat of urban catastrophic fire also exists, primarily in the industrial portions of the City (except for SRI and the City's Corporation Yard, located in the central portion). Twelve firms store (and in some cases manufacture) hazardous fuels and chemicals.

SPECIFIC ISSUES FOR THE CITY OF REDWOOD CITY*

Strong ground shaking, limited flooding (100-year storm), landslides, limited inundation due to dam failure, circulation and access in the event of a major earthquake, structural hazards in older buildings and brush fire potential are among the typical geotechnical and safety constraints that could affect portions of Redwood City.

In the Redwood Shores area, extensive studies by competent consultants have been performed (see Seismic Advisory Board Reports of 1965-1972) which indicate no significant geotechnical constraints upon the implementation of the recommendations. By adoption of the 1973 Uniform Building Code and Redwood City Ordinance No. 1613 incorporating Article X, Seismic Requirements, for the total City including the Bay Mud lands areas, Redwood City significantly provides for the mitigation of structural and other related seismic safety concerns.

The 1972 findings of the aforementioned Seismic Advisory Reports are as follows:

I. <u>Faults and Fault Displacements</u>

There is no evidence for late Quaternary fault movement at Redwood Shores or in adjoining areas (Appendix 1, Plate 1-1); nor does the historic record include any episode of surface faulting in these areas. One or more faults may exist in the bedrock beneath the site area, but there is nothing to suggest the presence of faults in the overlying section of Pleistocene and Holocene deposits, which represent the last several hundred thousand years of geologic time. Moreover, none of the known active faults in the San Francisco Bay region can be reasonably projected into the site from adjacent areas, and those other faults that might be so projected are overlain by unbroken deposits of Pleistocene age.

Consistent with these factors are the records of seismicity in the Bay region and records of more local seismicity, as noted below. We find no reason to alter our earlier conclusion, expressed in the 1975 report, that permanent ground displacements reflecting surface faulting at the site can be regarded as extremely unlikely.

II. <u>Seismicity and Ground Shaking</u>

The historic record includes no earthquake epicenters in the area of Redwood Shores (Appendix 1, Plate 1-1). Newly available lists of local seismic events further indicate that no earthquake of Richter Magnitude 2 or greater occurred at or near Redwood City during the eleven-year period January 1, 1960-December 21, 1970. A compilation of epicenters for microearth-

*THIS ISSUES PAPER WAS PREPARED BY REDWOOD CITY BUILDING DEPARTMENT (9/19/75) AND DOES NOT NECESSARILY REFLECT THE VIEWS OF THE COUNTY PLANNING STAFF OR THEIR CONSULTANTS

quakes (down to Richter Magnitude of approximately -1) for the year 1968 fails to show even one epicenter in the area of Redwood Shores. Thus, the bedrock immediately under the area can be regarded as having very low historic seismicity, and on this score, it stands in marked contrast to that in areas immediately adjacent to major active faults in California. It can be expected to respond, however, to ground motions originating along nearby active faults.

The strongest future ground shaking in the site area probably will derive from earthquake activity along the San Andreas, Hayward, and Calaveras faults. During a theoretical project lifetime of one hundred years, at least one earthquake of Magnitude 7 to 8-1/4 can be expected to occur on one of these major faults. In addition, several earthquakes of Magnitude 6 to 7 can be expected within the San Francisco Bay region. Any of these earthquakes would cause moderate to severe shaking throughout this region.

The relatively thick sequence of soft materials overlying the basement rocks in the site area is expected to have a significant influence on the motion characteristics of earthquakes observed there, hence a special study of this influence was made when the original Report of Seismic Investigation was prepared. However, techniques for making such studies have been greatly improved during the past six years, and for the present review it was accordingly requested that Dames and Moore re-investigate the modifying effects of the soil on earthquake ground motions at the Redwood Shores site.

In the Sames and Moore report describing these new studies, calculated ground motions at the Redwood Shores site for a theoretical, small, distant earthquake are compared with the motions actually observed at the same location during the moderate Santa Rosa earthquake of 1969. Relatively good agreement was found between the predicted and the observed ground motions. This invites some confidence in the mathematical analysis technique, but it must be noted that the intensities of motion recorded in 1969 were too small to be interpreted accurately. Calculations also were made for the ground shaking to be expected at Redwood Shores from a strong earthquake located on the nearest part of the San Andreas fault. Although the section of marine and alluvial deposits at Redwood Shores was found to have caused significant amplification of actual bedrock motions generated by the Santa Rosa earthquake, this analysis fortifies current engineering judgement that much smaller amplifications of motions are to be expected during major earthquakes such as the one assumed for study purposes.

The new studies of soil modification effects, based upon greatly improved methods, lead to the same conclusions as those presented in the 1965 report. Shore-period components of the expected ground motion, which are most likely to cause damage to typical

one- and two-story buildings like those built in Redwood Shores to date, are not significantly different from those to be expected at a site in downtown Redwood City. Long-period components of strong earthquake motions, however, would be amplified by the soil cover. This would require the use of more stringent design procedures for tall, flexible buildings sited in Redwood Shores as compared with similar buildings proposed for sites with firmer foundation materials.

III. Ground Stability

It was concluded in the 1975 Report of Seismic Investigation that no general problem of seismically-triggered, massive landsliding exists within the Redwood Shores area, and this conclusion is here reaffirmed. It was earlier suggested that some local problems of ground stability might exist along protective dikes, and problems of this kind have been recognized during the past six years. All are being dealt with by conventional procedures of proven effectiveness, e.g., by constructing the perimeter dikes with conservatively flat slopes and by providing conservatively large setbacks from underwater depressions or channels.

The records of several hundred exploratory borings in the Redwood Shores area, including more than 200 made since 1965, indicate a subsurface sequence of sediments in which cohesive muds and clays are dominant. Some bodies of sand and gravel have been found, generally in depths greater than forty feet, but no continuous sheet of such material can be inferred. Instead, the granular, relatively cohesionless sediments evidently form tongues and lenses a fraction of an inch to possibly as much as 25 feet thick, with an average thickness of less than 4 feet. Their total volume is a tiny fraction of the sedimentary prisms in which they occur. The depths, shapes and spatial relationships of these bodies, together with the results of static and dynamic testing of their contained materials (Section II in accompanying volume), lead us to conclude that they should remain stable under conditions of strong seismic shaking. Under the highly unlikely circumstances of partial liquefaction, the effect on stability of perimeter dikes would not be critical, because the materials that might be partially liquefied are deeply buried and because the dikes, generally extending only 3 to 6 feet above the finished interior land surface of the project area, are very minor features.

The possibility of failure by massive sliding in the project area can be conceived to exist only with reference to the ship channel to the northeast. This channel is approximately 45 feet deep. There is no geologic or topographic evidence, however, to suggest that underwater slides have ever occurred in the channel, despite very severe shaking as in the 1906 earthquake. Further, the channel lies more than a mile from the project area, and we conclude that any further failure conceivably originating along the ship-channel depression would be too distant for propagation into the Redwood Shores area.

The channel dredged to Elev. 88 in Belmont Slough appears to be too shallow a depression to invite massive sliding, and it is too far removed from the perimeter dike to threaten the integrity of that structure.

Consolidation of natural subsurface sand and gravel lenses by severe seismic shaking is not expected to cause more than a few inches of surface settlement. The 3- to 5-foot thickness of man-made land fill placed over the entire area can be regarded as stable in this context; indeed, it probably is superior to the underlying strata, because the fill has been uniformly placed and compacted under engineering controls. As a result of such placement and compaction controls, land fills of either granular or cohesive soils are equally satisfactory and stable under conditions of seismic shaking.

Based on reasonably detailed foundation explorations and tests, together with stability analyses reviewed by and coordinated with the U.S. Corps of Engineers (see Section I in accompanying volume), it is concluded that the Perimeter Dike around Redwood Peninsula is reasonably safe against damage due to severe seismic shaking.

IV. Tsunami Effects

The historic record of tsunami effects in San Francisco Bay, which included information newly available during the past six years, indicates that the bay has been significantly influenced only by tsunamis representing distant earthquakes. There is no record of tsunamis generated by California quakes. Tide gauge records show that tsunamis entering the Golden Gate are damped considerably as they propogate toward the south end of the Bay; their amplitudes are reduced at least 75 percent by the time they reach Redwood Shores. This damping effect, taken together with the fact that the greatest tsunami yet recorded at the Golden Gate was only three feet high, makes it very unlikely that the 3.5-foot Freeboard (above maximum astronomical tide) at the Bayfront levees of Redwood Shores would ever be overtopped by tsunami action.

V. Earthquake Effects on Structures

In the 1965 report, anticipated earthquake effects on structures at Redwood Shores were compared with those experienced at downtown San Francisco in 1906, and it was suggested that existing building codes would provide a satisfactory basis for earthquake-resistant construction. As already noted in our findings on seismicity and ground shaking, more recent studies have confirmed the previous estimates of ground shaking to be expected in the project area. However, extensive research during the past six years has indicated that reactions of certain structures to that ground motion may be substantially different from those anticipated in current building code provisions. While commonly used provisions of the building code may be generally suitable for small or rigid structures, there may be a serious deficiency

if they are applied to tall or flexible (long-period) structures at Redwood Shores without imposing other qualifications not currently required by codes.

Studies by Dames and Moore have indicated the degree to which structures of varying stiffness properties (period of vibration) will react to the expected ground motion in the site area. We recommend the use of these newly-developed base shear coefficients in place of the Uniform Building Code expressions. Moreover, experience from recent earthquakes and the results of recent research and analysis lead us to suggest revisions of past design practice, especially with respect to bracing methods, base shear formulae, allowable concrete stresses, overturning stresses in columns, use of ductile materials, and foundation ties. These recommended revisions are detailed in Appendix V.

VI. Settlement and Subsidence

Additional data on subsurface conditions have been obtained since 1965 from more than 200 borings and some laboratory testing of samples. These data support and substantiate earlier evaluation of the amounts and duration of ground settlements caused by area development and land filling. Additional settlements that might be caused by the construction of one- and two-story frame residences on land-filled areas can be considered minor, in accord with earlier findings. However, construction of a high-rise building can lead to major settlement at a given site, and this factor should be specifically evaluated by a foundation engineer prior to such construction.

In regard to ground subsidence in the Redwood Peninsula, a study made since 1965 has shown that a local subsidence bowl, centered around the groundwater well field of the Ideal (Pacific Portland) Cement Company south of Bair Island, has been developing since the 1920's. Prior to 1934, this bowl probably was no more than one foot deep, but no survey data are available to support this estimate. Subsequent surveys have shown that the bowl deepened about 3 feet during the prior 1934-1970 (see Appendix VI, Plate VI-3). The edge of the bowl cannot be defined, but it probably extends for some distance into the southeast portion of the Improvement District at Bair Island. If this is true, the old levees thereon may have moved downward in elevation by amounts ranging from 6 inches to 2 feet. The current rate of subsidence in this vicinity ranges from 0 to 3/4 inch per year. This rate is expected to decrease continuously in response to closing of the Ideal (Pacific Portland) Cement Plant and the attendant virtual cessation of pumping from the water wells. More than 95 percent of the Redwood Shores area probably has been unaffected by the subsidence, and no new subsidence bowls are expected because groundwater withdrawals within the site area will not be allowed.

Areas subject to flooding in the event of a 100 year storm are relatively minor with respect to developed areas of Redwood City based on local engineering studies and maps approved by HUD in accepting Redwood City as a participant in the Federal Flood Insurance Program (see Public Works Department official flood maps).

Potential landsliding exists in the areas west of Farm Hill Boulevard and in some portions of the Emerald Lake area within the City.

Inundation that may result from dam failure at the Emerald Lakes is likely to be confined to the lands immediately adjacent to the natural drainage courses in the upper reaches of these streams (primarlily westerly of the Alameda de las Pulgas).

Safety issues in the City involve: circulation and access problems (in the event of a major earthquake), fire potential due to City areas subject to brushfires, the incidence of the manufacture, storage and transportation of hazardous liquids or substances within the City and structural hazards as related to earthquakes and buildings existing prior to 1933 especially those constructed of unreinforced masonry.

SPECIFIC ISSUES FOR THE CITY OF SAN BRUNO

Geotechnical problems within the City of San Bruno are: strong ground shaking, high potential for surface rupture along the San Andreas fault and the Serra fault, subsidence*, liquefaction* and local flooding. A few landslides are known to exist; however, landslide potential is generally low.

Flooding, in the event of a 100-year storm, is anticipated in the following areas: east of San Mateo Avenue from North Brae School to the marshes adjacent to the Bayshore Freeway, near City Park (South of Crystal Springs Road), and immediately north of Capuchino High School.

Surface rupture potential is moderate to high due to the presence of the Serra thrust fault and the San Andreas fault zone. Strong ground motion generated during a major earthquake will cause, according to the "San Francisco Scale" devised by Borcherdt and Gibbs (1975), 'very violent' to 'very strong' intensities of ground shaking, resulting in severe to moderate damage.

Liquefaction potential in the event of a major earthquake is moderate to low, and will probably be localized in areas underlain by clean sand lenses saturated by high groundwater and beds which are known to exist within the Bay Mud and the Merced Formation. The area with highest potential for liquefaction is located adjacent to the Bayshore Freeway, especially near the San Bruno Avenue interchange. Localized liquefaction may occur from Belle Air School through City Park (refer to the Geotechnical Hazards Synthesis Maps for a more concise description of the affected area) and in the vicinity immediately north of Capuchino High School.

Subsidence is also known to occur in the Crestmoor and Monte Verde areas of the City, with some coincident foundation failure and concomitant housing loss. Portions of the City are also subject to differential settlement, especially in the area where historic marshes are known to have existed. Problems may also occur where structures are built on ancient creek beds without careful placement of engineered fill.

Landslides have occurred in the past within San Bruno (principally on Crestwood Drive); however, the potential for future slides is moderate to low. Bedrock material (Merced Formation) is considered moderately stable, although surficial* soils may be expansive and subject to creep within the hills. Erosion of the Merced Formation is an apparent geologic problem, especially in the Crestmoor area of the City.

*See Glossary (Vol. II, Appendix A)

Safety issues in the City of San Bruno include catastrophic* fire hazard (primarily in the hills), structural hazards, and disruption of utilities. Fire hazard in the hills is limited primarily to the Crestmoor Canyon area, which is heavily wooded, and those portions of the City where wood shake or shingle roofs predominate. Industrial fire hazard is associated with the transmission of jet fuel to San Francisco International Airport. Fire hazards are mitigated, to some extent, by the fact that San Bruno has a Class 3 fire department and water system (which is very good in terms of flow and pressure).

Structural hazards exist with respect to a few unreinforced masonry structures in the City, buildings constructed prior to 1933, and those portions of the City which have been constructed on un-engineered fill (particularly in the areas of historic marshland, ancient creekbeds, and Bay Mud). The two private schools located within the City may also constitute structural hazards, since they are not required to conform with the State Field Act. Additional structural hazards are posed by the fact that the rift zones of both the San Andreas and Serra faults contain numerous public facilities, including schools and shopping centers. Thus, the most severe ground shaking (and, therefore, building stress) will occur where there are large concentrations of people.

Collapse of freeway structures is an additional hazard. San Bruno is transected by Interstate 280 and 380. Collapse of structures crossing these freeways should only involve the temporary isolation of portions of the City, however, since new access can be graded across the freeways with relative ease in many areas. The delay necessitated to provide new access may have adverse affects, though, on injured persons in the cut-off areas, unless emergency first-aid stations and/or mobile hospital facilities are provided.

Utility disruption is the final major safety issue. Movement on either the Serra or San Andreas fault will effectively rupture all lines crossing same. Major utility disruption will result if the 100 KV overhead electrical transmission line along Fleetwood Drive is damaged, or the 16 inch gas transmission line in Skyline Boulevard.

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*See Glossary (Vol. II, Appendix A)

SPECIAL ISSUES FOR THE CITY OF SAN CARLOS

Geotechnical concerns within the City Limits of San Carlos are: landslides, expansive soils,* groundwater problems, seismic ground shaking, liquefaction,* and flooding. The principal underlying bedrock is the Franciscan assemblage, which is generally firm to hard. However, sheared shales within the Franciscan formation, and interbeds of claystone within Butano Sandstone, cause both foundation problems and slope instability, especially where geologic structure is adverse to man-made cuts or natural banks which have been undercut by stream erosion.

Landslides and expansive soils are a primary concern with respect to new development within San Carlos. Groundwater seeps in the hills have saturated the surficial soils and have caused expansive problems in localities where sheared Franciscan shales and claystones (within the Butano Sandstone) have been exposed. Where slopes are relatively steep, soil instability concerns are creep and expansion. The highest potential for these exists during the rainy season, when the ground becomes saturated and clay within the soil swells. The interfrictional forces within the soils are weakened in this state, resulting in down-slope creep under the influence of gravity. Landslides of 50-500 feet in maximum dimension are existing problems. An area of particular concern is Belmont Hill, where numerous slides exist, although other hilly areas have landslide problems, as well; the Franciscan and Butano bedrock within San Carlos are known to have potential landslide problems. Areas of future development, in which adverse geologic structure is known to exist, should be thoroughly investigated and mitigation measures taken prior to development.

Though surface rupture is not a hazard within San Carlos, strong lateral ground acceleration resulting from surface rupture along the nearby San Andreas fault is anticipated, which may cause moderate to severe damage. Bedrock units will respond differently within the City. Areas underlain by firm Butano Sandstone and the Franciscan assemblage should experience less violent ground shaking than areas of weakly consolidated to unconsolidated alluvial deposits (in the lower lying land between the hills and the Bayshore Freeway). However, severe ground shaking may activate landslides and cause local soil failures within the weaker units of the hillside bedrock materials. Liquefaction potential will be greatest within the poorly-consolidated to unconsolidated zone between the Bayshore Freeway and El Camino Real, where saturated clean sand lenses and beds are incorporated in the alluvial deposits. Very localized liquefaction may be experienced within the three major drainage courses in the City.

Although a fault is known to exist through Belmont Hill and Brittan-Knolls, it is considered inactive with a low potential for surface rupture. However, caution should be taken when developing

*See Glossary (Vol. II, Appendix A)

adjacent to this fault, and setbacks recommended in engineering geology reports should be heeded.

In the event of a 100-year storm, flooding is a major concern. The areas principally affected will be the lower reaches of Cordilleras Creek, the lower portions of Pulgas Creek, Brittan Creek easterly of Elm Street, and the area east of El Camino Real. Bedrock in the hilly area is principally of low permeability, thus increasing the run-off rate during intense storms. Run-off waters will be channeled through the drainages mentioned above, and the overflow will inundate the lower-lying industrial, residential and business districts, principally as a consequence of constrictions in creek capacity generally caused by conduit size.

Safety issues in the City of San Carlos include wildfire potential in the hill areas of the City, as well as structural hazards and disrupted circulation resulting from a seismic event. The potential for major industrial fire also exists.

The danger of a catastrophic* fire in Devonshire Canyon is a major problem, due to the dense growth of broadleaf evergreen forest. Roads in the area are of insufficient capacity, access limited, and water supplies marginal. The ability to get emergency vehicles into the area, while evacuating and/or rescuing residents could be substantially impaired by congestion of the few existing roads.

Structural hazards in San Carlos are primarily limited to pre-1933 buildings, found for the most part in the central portion of the City. However, buildings of other than wood-frame type, constructed between 1933 and 1948 may also pose structural hazards. Since all of the schools in San Carlos comply with the Field Act, no ascertainable problem exists in this regard. Most of the places of public assembly within the City are also reported to be of relative structural soundness, with the possible exception of the City's theaters, whose structural condition is not fully understood at this time.

The third safety issue in San Carlos stems from the potential for disrupted circulation following a major earthquake. Except at the Alameda de las Pulgas, conduits permitting crossings of creeks, and particularly Cordilleras Creek, could be severely damaged and/or destroyed, with a concomitant limitation on access to Sequoia Hospital from San Carlos.

Industrial fire within the City is associated with two potential hazards. Hydrogen gas storage and transmission lines exist in the easterly area, and manufacturing plants have small stores of flammable and/or noxious chemicals.

SPECIFIC ISSUES FOR THE CITY OF SOUTH SAN FRANCISCO

Major geotechnical concerns of the City of South San Francisco are strong ground shaking and resultant liquefaction potential*, flooding, tsunami* inundation, settlement of fills, surface rupture in the Westborough area, and locally expansive soils.*

The most important concern is the potential for strong ground shaking, the effects of which are magnified by liquefaction. Much of the City is underlain by the Merced Formation, consisting of sands and gravel with a low to moderately low liquefaction potential. However, areas underlain with Bay Mud and associated sand lenses may experience liquefaction due to shear wave amplification* within the poorly-consolidated to unconsolidated sediments. Though much of this latter area is industrial, damage may be extensive and will especially affect those structures of pre-formed tilt-up construction. The area of highest liquefaction potential is from Point San Bruno southward to the City boundary and, principally, east of the Bayshore Freeway. Local liquefaction may occur along Colma Creek. Subsidence may also result from strong ground shaking, due to possible consolidation of existing fills which would result in damage to foundations and possible failure of structures with weak pinning to foundations.

Flooding, in the event of a 100-year storm, would inundate the area adjacent to Colma Creek and spread out through the industrial area from Point San Bruno to the City boundary to the south (subject to mitigation by the Colma Creek Flood Control project). Tsunami inundation can be anticipated to encroach on the flatter areas of Bay Mud. The areas most severely affected would be those with elevations of 5 feet or less, including the oil storage tanks and Oyster Point Marina.

Surface rupture may be expected along the San Andreas fault zone in the Westborough area. Several buildings within the rift zone have already been condemned by the City.

Expansive soils can be anticipated locally within the Merced Formation and on the lower slopes of San Bruno Mountain, where colluvial* deposits are known to exist. These areas may present foundation problems for existing structures.

Safety issues in the City of South San Francisco are largely confined to: structural hazards (especially in pre-1933 buildings), maintenance of emergency access to all portions of the City in the event of a catastrophe, and hazards of catastrophic* fire and/or explosion from the manufacture, transport, and/or storage of chemicals and noxious materials. With respect to the hazards related to pre-1933 structures, three areas appear to be affected: the entire central area (bounded by Railroad Avenue, Chestnut

*See Glossary (Vol. II, Appendix A)

Avenue, Tamarack, Park Way, Alpine Terrace, Linden Avenue and Highway 101), the Randolph Avenue/Pecks Lane area, and the Industrial Village area between El Camino Real and the railroad. Since buildings in these areas pre-date building codes and structural strength considerations, these portions of the City may be considered to be most hazardous in terms of potential loss of life, injuries, and property damage.

Emergency access is another major consideration. In the event of a major earthquake, the bridge and culverts across Colma Creek could be severely damaged and/or destroyed, as could railroad undercrossings and overcrossings, and interchanges with both Interstate 280 and Highway 101. This would have the effect of isolating several portions of the City and inhibiting the provision of emergency services. The most susceptible areas are the Westborough area and the commercial-industrial region east of the Bayshore Freeway (Highway 101). A critical access problem also exists with respect to Kaiser Hospital, which relies on one access point via a culvert across Colma Creek.

The third major hazard focuses on flammable, explosive, or noxious substances. There are numerous manufacturing concerns in South San Francisco which are involved in the handling of materials of this nature, as follows:

1. Nitro-cellulose and flammable liquids - DuPont Company, Fuller-O'Brien Company, Sun Chemical Company, and D.J. Simpson Company;

2. Flammable liquids only - Reichold Chemical Company, Shell Oil Tank Farm, Olympic Oil Company, Pacific Crown Distributors, San Francisco International Airport Tank Farm, Klix Chemical Company, H. B. Fuller Company, and Royaltone Paint Company;

3 Chlorine - City of South San Francisco Sewage Treatment Plant;

4. Ammonia - South San Francisco Cold Storage Company, Dubuque Packing Company, Hirschberg Freeze Drying, Armour Meat Company, Tomales Bay Creamery, and Edwards Wire Rope Company;

5. Propane - Armour Meat Company and Bethlehem Steel Company;

6. Cyanide and flammable liquids - E.F. Houghton Company;

7. Acids and butane - Edwards Wire Rope Company;

8. Acetylene and liquid oxygen - Linde Air.

A particular problem exists if any of these substances were to find their way into the storm drain system or Colma Creek. An associated hazard exists from the 8" jet fuel transmission line which traverses South San Francisco from Brisbane to the airport tank farm.

SPECIFIC ISSUES FOR THE TOWN OF WOODSIDE

The most important geotechnical issues in Woodside are: (1) landslide potential and (2) surface rupture along both the San Andreas fault zone and the associated Cañada fault. Landslide potential is moderate to high, especially in areas underlain by siltstone and claystone. Soils are anticipated to be moderately expansive,* especially where the claystone and siltstones of the Santa Clara and Purisima formations and the Franciscan assemblage (consisting of sheared serpentine, shale, and siltstone) are predominant.

Surface rupture can be anticipated within Woodside along the San Andreas fault zone and/or the Cañada fault in the event of a major earthquake. High ground accelerations and strong ground shaking can be expected to cause moderate to severe damage. Older structures will, in all probability, sustain the worst damage and existing landslides may be reactivated.

In terms of public safety, three major issues confront the Town: catastrophic* fire, access for emergency vehicles, and the relative lack of availability of emergency medical facilities. Fire hazard is severe, due to dense high-fuel vegetative cover throughout most of Woodside. When coupled with the remoteness of much of the Town, this presents a substantial problem in terms of providing adequate fire suppression services. In addition, substantial portions of the Town have very limited access, which will severely inhibit the ability to get emergency vehicles into an area while, at the same time, bringing people out (either through rescue or evacuation efforts). Width of roadways is a corollary to the problem: although Town standards require a 20 ft. width (i.e., of bare minimal clearance for two emergency vehicles), many roads do not conform. In addition, the entire Town could be effectively cut off in an earthquake via the closing of very few roads, all of which either traverse areas of high landslide potential, cross bridges, or involve freeway structures at Interstate 280. This factor increases the need for interim emergency medical facilities, inasmuch as all access to hospitals could become blocked off.

*See Glossary (Vol. II, Appendix A)

SPECIFIC ISSUES FOR THE COMMUNITY OF EAST PALO ALTO

Major geotechnical issues within the unincorporated community of East Palo Alto are ground shaking, liquefaction potential*, and inundation from tsunamis* and dam failure. Flooding from excess surface run-off is another type of inundation which most of East Palo Alto can expect in the event of a 100-year storm (the exception being the central part of the community).

In the event of strong ground shaking, shear wave amplification* may be intensified, due to the nature of underlying sediments, with resulting damage to chimneys, masonry and brickwork, foundations, and retaining walls. Lurching of buildings may occur where weak foundations are present. East Palo Alto is underlain by saturated alluvial sediments, which may contain clean, saturated sand lenses. Where this occurs, the liquefaction potential may be moderate to high. It is most likely to occur in the easterly portion of the Palo Alto Gardens subdivision and the Faber Tract. Additionally, the dikes surrounding East Palo Alto may fail if underlain by liquefiable sand lenses.

The potential for tsunami inundation is limited to the Faber Tract and Cooley Landing. The dikes which separate these areas from the developed portions of East Palo Alto are not expected to be overtopped, in any event. Inundation may also occur from rupture of the Searsville Lake dam.

The potential for severe flooding is significant. The high tides, combined with heavy surficial run-off (affecting both San Francisquito Creek and the baylands) create the potential for inundation in both the eastern and western portions of the community.

Safety issues in East Palo Alto are similar to those involving the neighboring Belle Haven portion of Menlo Park. Both areas have limited access, having to rely on crossings over the Bayshore Freeway. In the event of an earthquake, the freeway structures which provide access could be damaged or destroyed, necessitating the creation of interim ingress/egress points across the Bayshore Freeway, itself. Until such emergency crossings could be installed, provision of emergency medical care and/or rescue units would not be possible (fire and police protection would be unaffected, since there is both a fire station and a sheriff's substation within the community). Access across the Dumbarton Bridge would, in all probability, also be impaired.

Structural hazards are chiefly associated with buildings constructed prior to 1948, especially those few buildings which are not wood-frame construction. The commercial greenhouses in East Palo Alto can also be expected to suffer heavy damage in the event of an earthquake.

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*See Glossary (Vol. II, Appendix A)

Urban fire hazards and the potential for the release of noxious fumes is associated with the industrial portions of East Palo Alto, where chemicals are both manufactured and utilized in various processes.

SPECIFIC ISSUES FOR THE COMMUNITIES OF MONTARA, MOSS BEACH AND EL GRANADA

Geotechnical issues for the Montara, Moss Beach and El Granada area are: faulting with associated surface rupture and liquefaction,* landslides, expansive soil,* flooding, tsunami inundation,* and low to high coastal bluff instability. Of particular concern is the Farallone View School, which is situated on an active trace* of the Seal Cove fault.

Several traces of the Seal Cove-San Gregorio fault zone are prevalent within the area, with evidence of off-set* in geologically-recent alluvial* sediments. These faults are present in Moss Beach and Montara. Ground shaking generated by lateral ground accelerations may cause local liquefaction within the unconsolidated granular sediments near Half Moon Bay Airport and Princeton. Very high local liquefaction potential is present in the Montara and El Granada vicinities (refer to the Geotechnical Hazards Synthesis Maps for greater specificity).

Landslides, soil creep,* and expansive soil are prevalent throughout the area. Landsliding generally involves surface soil failures. Much of this area (as indicated by surficial landsliding), consists of expansive, clay-rich soil and colluvium.* Soil creep is common throughout the area and occurs principally when the soil is saturated (i.e., during the rainy season).

Flood prone areas are Denniston Creek, San Vicente Creek, and the Pillar Point marsh. Tsunami inundation will principally involve this marsh area, Princeton, Pillar Point Harbor, and the beaches along El Granada.

Coastal stability ranges from low to high in the Montara, Moss Beach, El Granada area. Large landslides are present along the coast at Seal Cove and about a mile to the south. Erosion of the beaches and cliffs from Pillar Point to Miramar is moderate to severe. The worst problems occur in the Miramar Beach area, where the cliffs are weakly-consolidated marine terraces and subject to severe erosion.

Safety issues for these unincorporated communities are much the same as for the City of Half Moon Bay: unreliable evacuation routes, potential isolation from the rest of the Peninsula in the event of an earthquake, and a lack of medical care facilities. Utility transmission lines can be expected to be disrupted if movement takes place on the San Andreas fault. Continued service from the Coastside County Water District's treatment plant on

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*See Glossary (Vol. II, Appendix A)

Denniston Creek may prove problematical, since the major distribution lines from the plant cross two active traces of the Seal Cove fault system.

Circulation within these communities is a potential problem in terms of providing emergency services or reliable evacuation routes, in that numerous areas rely on simple ingress/egress routes, often unimproved and/or improved to substandard widths.

Catastrophic fire is another potential safety hazard. Wildland fire potential exists, especially concerning the heavy stands of eucalyptus which are prevalent in the area. Urban catastrophic fire potential is generally limited to the fueling facilities at Pillar Point Harbor, and the LP gas distribution tank near the airport.

IV. POLICIES AND IMPLEMENTATION PROGRAMS

IV. POLICIES AND IMPLEMENTATION PROGRAMS

The policies and programs contained in this section apply only to the unincorporated parts of San Mateo County. The policies are designed to provide direction for future decision-makers in the achievement of the purposes, goals, and objectives of the Seismic Safety/Safety Element. They will serve as guideposts in determining the nature, extent, and application of implementation programs to be undertaken in both the public and private sectors. The programs are designed to provide a means for applying earth sciences data to governmental decision-making, and for introducing hazard mitigation measures into the development process.

The policies and programs incorporated into the Seismic Safety/Safety Element of each of the participating jurisdictions have been selected from the expanded array of alternative policies and programs included in the draft of the Element. The subsequent selection process eliminated those policies and programs which each jurisdiction found were not applicable or feasible for its particular circumstance, or not correctly reflective of its perception of risk. Policies and implementation programs are not listed in any intended order of priority.

ALLOCATION OF RESOURCES

Policies

1. Establish hazard reduction priorities so that judgments can be made regarding allocation of limited funds to the most critical areas or problems:

    a. Significant and impending threats to human life or safety;

    b. Unacceptable levels of potential economic loss;

    c. Potential for widespread social disruption;

    d. Significant threats to future populations or development;

    e. Problems which are likely to result in minor adverse impacts.

EXISTING LAND USE

Policies

2. Establish and enforce standards and criteria to reduce levels of risk involving existing development from natural hazards to an acceptable level for all land use.

3. Encourage the reduction of unacceptable risks associated with hazardous buildings through action programs, including but

not limited to renovation, occupancy reduction, and selective demolition.

Implementation Programs

4. Determine the level of acceptable risk which can be borne, utilizing the Geotechnical Hazards Synthesis Maps, Risk Analysis Input to Decision-Making, and the Land Capability Maps and Mitigation Matrices, when available.

5. Investigate the feasibility of initiating a program of building inspection to identify all structures that 1) do not meet modern earthquake standards for construction, or 2) conform to design criteria of the building code since its modification regarding seismic hazard mitigation.

6. Investigate the feasibility of a program for the renovation, occupancy or selective elimination of hazardous structures, or appendages thereto.

7. Recommend, through State and federal legislators, the modification of State and federal renewal and redevelopment assistance programs to provide for the abatement of earthquake hazardous old buildings.

8. Advocate and support State and federal financial assistance programs for the abatement of pre-1933 earthquake hazardous structures.

9. Urge legislation to require sellers of real estate to disclose pertinent geotechnical information to buyers regarding the property and/or structures under transaction.

10. Support legislation providing for tax incentives to encourage the repair or demolition of earthquake-hazardous old buildings.

FUTURE LAND USE AND DEVELOPMENT

Policies

11. Require that all new development incorporate adequate hazard mitigation measures to reduce risk from natural hazards to an acceptable risk level.

12. Integrate geotechnical hazard data and risk evaluations into the decision-making process for all future development.

Implementation Programs

13. Modify the building code to require that new construction withstand at least that level of peak ground acceleration*

*See Glossary (Vol. II, Appendix A)

which reflects the level of acceptable risk, per Volume II, Appendix C (Risk Analysis).

14. Implement the Land Capability Maps and Mitigation Matrix (when available) by incorporating them into existing decision-making procedures for both public and private-sector projects.

15. Require that proposed structures of more than four stories utilize dynamic analysis procedures for assessing structural design requirements.

16. Require that potential geologic, seismic, soils, and/or hydrologic problems confronting public or private development be thoroughly investigated at the earliest stages of the development process, and that these topics be comprehensively evaluated in the Environmental Impact Report for each project, by persons of competent geologic expertise.

17. Review and update grading ordinances and pertinent administrative procedures in order to apply hazard reduction methodologies to the existing permit-granting process.

ZONING AND DIVISION OF LAND

Policy

18. Integrate geotechnical hazard data and risk evaluations into zoning and subdivision ordinances.

Implementation Programs

19. Review the subdivision ordinance, the zoning ordinance and other related ordinances, rules and regulations and modify them as needed to include hazard reduction in the approval process for dividing and developing land where the Geotechnical Hazards Synthesis Map indicates the need for same, or where geotechnical data indicate the potential presence of a hazardous condition.

PUBLIC UTILITY SYSTEMS

Policies

20. Encourage the State Public Utilities Commission to establish increased design and construction standards for utility systems traversing active or potentially active fault zones, in order to lessen risk of service disruption in the case of a seismic event.

21. Encourage agencies and utility companies which supply lifeline services to install facilities and system modifications which will lessen the risk of system breakdown during a catastrophe.

Implementation Programs

22. Participate in a cooperative County-wide program between PG&E, Pacific Telephone, and fire protection agencies throughout the County to improve 1) power, gas, and telephone line inspections and 2) the selection of sites for new installations.

23. Participate in a cooperative program with the Southern Pacific Transportation Company and other affected jurisdictions to review the Seismic Safety/Safety Element with respect to possible impact on Southern Pacific storage, fueling, maintenance, station, and rail facilities.

24. Participate in a cooperative study involving the various public utilities, municipal agencies, and districts and California Department of Transportation in reviewing the Seismic Safety/ Safety Element for the purpose of determining impact of a major earthquake on storage and transmission facilities (including gas, electricity, and communication transmissions), water tanks, major distribution/transformation network centers, major thoroughfares, bridges, and potential evacuation routes.

25. Urge the Public Utilities Commission to require that public utility companies apply the policies contained in local Seismic Safety/Safety Element to their planning and operation of their facilities, and coordinate said activities with local planning agencies.

CRITICAL USE STRUCTURES

Policies

26. Provide greater safety for (future) critical use structures (e.g., hospitals, schools, public assembly facilities, dams, transportation corridors and utilities) through careful site selection, appropriately comprehensive site investigation, and enforcement of codes and regulations containing provisions for seismic risk reduction.

27. Encourage the strengthening or demolition of seismically hazardous school facilities, including private schools and colleges.

28. Require that critical use facilities provide alternate sources of electricity, water and sewage disposal, in the event that regular utilities are interrupted in a disaster.

29. Require the strengthening or demolition of seismically hazardous structures used for places of public assembly.

Implementation Programs

30. Require future critical facilities to be sited only in those areas of 1) low fire hazard, 2) not subject to flood or dam inundation*, and 3) where other geotechnical risks are deemed to be acceptable.

31. Initiate coordination with County Superintendent of Schools regarding 1) the analysis of the level of geologic risk at existing and proposed school sites and 2) the formulation of hazard mitigation strategies.

32. Advocate and support the introduction of State legislation to require that existing critical facilities including public and private schools be brought into compliance with contemporary seismic design and construction standards.

33. Advocate and support legislation to provide State financial assistance for the structural strengthening of public and private hospitals and schools which have been found to be inadequately designed and constructed to resist seismic forces.

34. Seek federal and/or State assistance to examine critical facilities for disaster resistance capacities (including ability to withstand strong ground shaking) with the review of all facilities constructed prior to 1948 to be done by a structural engineer. These facilities include:

    a. electrical sub-stations;
    b. fire stations;
    c. aqueducts & pipelines;
    d. utility lines & related structures;
    e. governmental buildings & corporation yards;
    f. hospitals and clinics;
    g. ambulance service firms;
    h. sewage treatment plants;
    i. water acquisition, storage, treatment, and transmission facilities;
    j. radio stations and transmission facilities;
    k. television stations and transmission facilities;
    l. microwave stations;
    m. telephone exchanges;
    n. telegraph facilities;
    o. Highway Patrol, sheriff and police facilities;
    p. Civil Defense facilities;
    q. theaters, auditoriums, churches, and public assembly structures with a capacity of more than 100 people;
    r. structures housing emergency supplies (e.g., blood banks, pharmaceuticals);
    s. structures involved in food distribution.

Review should include such site considerations as are likely to render each facility inoperable in the event of a catastrophe, including access roads, external utility requirements, structural integrity, and the geology of the site.

35. Undertake geologic studies of all public structures which are located in areas of the most severe geologic risk, to determine whether those facilities meet the definition of acceptable risk or whether they should be moved, phased out, or abandoned.

36. Implement a phased program for the renovation or replacement of publicly leased or owned facilities which do not meet current seismic design and construction standards.

37. Request that the City and County of San Francisco review this Seismic Safety/Safety Element with respect to their water storage and transmission facilities, the San Bruno Jail, and San Francisco International Airport.

37a. Critical use structures should be designed according to the "Recommended Lateral Force Requirements" of the Seismology Committee of the Structural Engineers Association of California.

RELOCATION ASSISTANCE

Implementation Program

38. Advocate and support the expansion of State and federal relocation assistance to aid persons and businesses displaced by hazard reduction programs.

HAZARD INSURANCE

Policies

39. Encourage insurance underwriters programs which improve public awareness and understanding of available earthquake, fire, and geologic hazard insurance.

Implementation Programs

40. Investigate the availability of earthquake insurance for both public and private structures, and make said information widely available to the public.

41. Participate in the Federal Flood Insurance Program, which also includes mudslide.

INTERJURISDICTIONAL COOPERATION AND COMMUNICATION

Policies

42. Continue to improve interjurisdictional cooperation, in regard to seismic safety and public safety concerns related

to dams, reservoirs, State highway and freeway structures, public utilities, regional geotechnical studies, and disaster response or emergency planning.

43. Support the County Disaster Office's emergency preparedness program.

44. Participate in and/or initiate long-range planning for post-catastrophe land uses for existing high-risk areas.

Implementation Programs

45. Participate in a cooperative County-wide program to pool natural hazard data which are developed either through special studies or via the project review process.

46. Urge the State Legislature to require that all State agencies (including school districts) and special districts apply the policies and provisions contained in local Seismic Safety/Safety Element to the planning and operation of their facilities, and coordinate said activities with local planning agencies.

47. Urge Congressional representatives to introduce and support legislation which would require all federal agencies, including the armed services, to apply the policies and provisions of local Seismic Safety/ Safety Element to the planning and operation of their facilities, and coordinate said activities with local planning agencies.

48. Participate in a cooperative County-wide building strong-motion instrumentation* program for buildings over four stories in height with an aggregate floor area of 40,000 square feet or more, and every building over six stories in height regardless of floor area, in order to broaden the existing data base on the amplification of frequencies of strong ground motion by multi-story structures.

EDUCATIONAL PROGRAMS AND RESEARCH

Policies

49. Encourage and participate in research on the relationship between geologic conditions and the risk associated with earthquakes, including risk reduction through prevention of earthquakes, e.g., lubrication of faults.

50. Encourage and participate in intensified research on geotechnical hazards other than earthquakes (e.g., liquefaction, subsidence, landslides, floods, dam failure and inundation).

*See Glossary (Vol. II, Appendix A)

51. Support or sponsor exhibits and presentations in elementary and secondary schools which demonstrate the more involved aspects of earthquakes, geologic hazards, floods, and fire dynamics (i.e., major contributing factors to fire hazard and the relationship of fire to the natural ecology), and to encourage parental cooperation and assistance in overall hazard education programs.

52. Encourage school districts and agencies working with the aged and/or handicapped to develop education programs relative to seismic awareness.

53. Encourage industries, which through the nature of their work are considered to be highly susceptible to seismic risks, to develop education programs regarding seismic awareness among their employees.

54. Support disaster information release programs for use in emergencies.

Implementation Programs

55. Develop an information release program to familiarize property owners and prospective buyers, design professionals, potential developers, and realtors with the Seismic Safety/Safety Element and implementation programs.

56. Coordinate with USGS and the Office of Emergency Service to distribute literature from these agencies on natural hazards and individual emergency preparedness. Sponsor public education displays and programs by the two agencies.

57. Initiate programs to educate all segments of community, including non-English speaking groups, regarding natural hazards and conduct presentations which include practical suggestions on what to do and not to do in the event of a catastrophe.

58. Compile a catalogue of available information on the structural integrity of buildings in the County in terms of seismic risk.

59. Advocate and support State legislation requiring that earthquake disaster drills be practiced regularly in all public and private elementary, intermediate, and secondary schools. Drills should include student evacuation and on-campus supervision and be augmented with a community-awareness campaign pertaining to how, when, and where children are to be reunited with their parents.

60. Conduct emergency drills on a regular basis in all public structures.

61. Direct the County Fire Chief to develop community relations programs designed to increase public awareness of fire department emergency capabilities, fire prevention, and the need for prompt emergency notification.

HAZARDOUS MATERIALS

Policies

62. Re-examine County regulations regarding manufacturing, storage, and usage of hazardous and/or explosive materials and modify as necessary to minimize potential hazards to local populations.

63. Encourage the Interstate Transportation Commission to establish more stringent regulations for the transportation of hazardous and/or explosive materials, especially through or near residential areas.

TSUNAMIS, SEICHES AND FLOODING

Policies

64. Consider the threat of tsunamis* in the planning and management of low-lying coastal and harbor areas.

65. Consider the threat of seiches* in the planning and management of shoreline areas.

66. Improve regulations regarding the placement of proposed land uses in areas of flood potential.

67. Modify design criteria regarding construction in high-risk flood areas to lessen risks to an acceptable level.

Implementation Programs

68. Modify land use plans in areas where tsunamis, seiches, and/or flooding are hazards, to permit only uses which will sustain acceptable levels of damage and not endanger human lives in the event of inundation.

69. Investigate the costs and benefits of constructing protective devices to diminish the level of risk.

DAM SAFETY

Policies

70. Consider potential risks from inundation in the development approval process.

*See Glossary (Vol. II, Appendix A)

71. Support the State-sponsored Dam Inundation Area Mapping Program.

72. Advocate programs to increase the earthquake resistance of dams and reduce the potential impacts of seismically-induced dam failures.

Implementation Programs

73. Consider the need to modify land use plans to prohibit high-occupancy and/or to protect critical use facilities in those areas which may be subject to inundation from dam failure.

FIRE AND HEALTH EMERGENCIES AND EVACUATION

Policies

74. Identify specific areas subject to wildland fire hazards and classify same according to the associated level of risk.

75. Improve standards and design criteria for structures in areas which have high fire potential in order to eliminate design features which heighten hazard exposure.

76. Develop a phasing program for future fire station sites and volunteer fire company development that will provide in-service protection as new areas are developed and occupied.

77. Increase public awareness of fire department emergency capabilities with particular emphasis on prompt emergency notification.

78. Evaluate past rescue emergencies to determine the types of rescue service required in specific areas.

79. Initiate and/or participate in evacuation planning programs and encourage public education regarding same.

80. Cooperate with other local jurisdictions in the consideration of land use in terms of fire and other hazards.

81. Support the establishment of a county-wide fire training facility.

82. Strengthen zoning and subdivision ordinances to provide for improved fire protection.

Implementation Programs

83. Support programs to reduce vegetative fire fuels in areas of extreme high fire risk, including weed and brush removal and control, and fire-retardant plant use.

84. Require precautionary measures (such as adequate shielding of facilities and the implementation of brush removal programs, in site design regarding industrial and commercial activities in moderate and high fire hazard areas.

85. Direct the County Fire Chief to delineate the severity classification of wildland areas on USGS Topographic Maps, based on the "Fire Hazard Severity Classification System for California Wildlands," developed by the State of California, Department of Conservation.

86. Direct the County Fire Warden to conduct a study of the fire defense systems in the hazardous areas, and to make recommendations on measures needed to improve fire protection insurance classifications.

87. Direct the County Fire Warden to evaluate the respective levels of risk in fire hazard zones and to make recommendations for mitigating these risks.

88. Adopt ordinances and standards regarding minimum water supply requirements for fire protection.

89. Review ordinances and standards regarding street and roadway design, including private streets or drives, and modify as needed to insure that adequate access is provided for emergency vehicles.

90. Adopt ordinances requiring the distinct and visible marking of all roads, streets, alleys and other public ways, and the street numbers of all structures.

91. Adopt a Fire Ordinance that will safeguard, to a reasonable degree, life and property from the hazards of fire and explosion.

92. Adopt rigid inspection standards for off-road vehicle muffler and spark arrester controls and closely control the usage of off-road vehicles during periods of high fire risk (low humidity and northeasterly winds).

93. Require all water in new privately-owned swimming pools in or adjacent to extreme fire risk areas be accessible to fire trucks for use in on-site fire protection.

94. Require that the fire agency be notified of the change of use of a structure when it involves public assembly, and require that a Certificate of Occupancy be required before such a change of use is permitted.

DEPENDENT POPULATIONS

Policies

95. Improve seismic design and construction of facilities housing dependent populations i.e., persons who rely upon the custodianship of others, such as jail inmates and hospital patients.

96. Provide for the needs of dependent populations in earthquake response and recovery operations and evacuation planning.

Implementation Programs

97. Review current building code requirements for facilities housing dependent populations, and improve code requirements where needed.

98. Enact ordinances requiring the preparation of internal emergency response plans for all facilities housing dependent populations.

ELEMENT REVIEW AND UPDATE AND COORDINATION

Policy

99. Review the Seismic Safety/Safety Element on an annual basis and comprehensively revise same whenever substantian new scientific efidence becomes available, and coordinate Element findings with other General Plan Elements.

Implementation Programs

100. Coordinate the Seismic Safety/Safety Element with other General Plan Elements.